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TM-80444
JSC-14700



(E79-10217) BRIEFING MATERIALS FOR PLENARY PRESENTATIONS: THE LACIE SYMPOSIUM (NASA) 216 p HC A10/MF A01 CSCL 02C

N79-26444

Unclas
G3/43 00217

BRIEFING MATERIALS FOR PLENARY PRESENTATIONS

THE LACIE SYMPOSIUM

OCTOBER 1978

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Sioux Falls, SD 57198

NASA
National Aeronautics and Space Administration

Lyndon B. Johnson Space Center
Houston, Texas 77058

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PLENARY PRESENTATION NO. 1

INTRODUCTION
R. MacDonald, JSC

NASA-S-79-10264

PLENARY SESSION

COORDINATOR, R. MAC DONALD, JSC

TITLE OF PAPER	PRESENTER
INTRODUCTION	R. MAC DONALD, JSC
THE NEED FOR IMPROVED GLOBAL INFORMATION	B. SCHERR, DATA RESOURCES, INC.
THE FOUNDATIONS OF LACIE	R. MAC DONALD, JSC
WHEAT AND ITS GROWING CONDITIONS IN LACIE STUDY AREAS	D. THOMPSON, JSC
TECHNICAL APPROACH	J. DRAGG, JSC
RESULTS	F. HALL, JSC
TECHNOLOGY TRANSFER	J. MURPHY, USDA
IMPACT OF LACIE ON A NATIONAL METEOROLOGICAL CAPABILITY	J. HILL, NOAA
CONCLUSIONS AND OUTLOOK	B. ERB, JSC

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PLENARY PRESENTATION NO. 2

THE NEED FOR IMPROVED GLOBAL INFORMATION

B Scherr, Data Resources, Inc

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EARTH RESOURCES - NTIS

NASA-S-78-16038

THE NEED FOR IMPROVED GLOBAL AGRICULTURAL INFORMATION

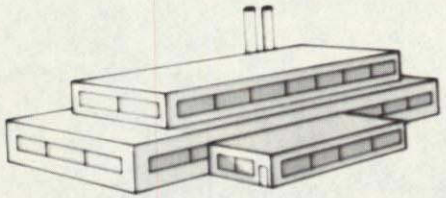
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- THE USERS - WHO ARE THEY?
- WHAT INFORMATION IS NEEDED?
- CURRENT INFORMATION SYSTEMS - HOW WELL DO THEY WORK?

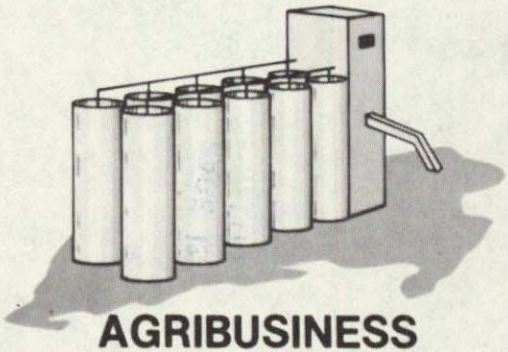
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THE USERS OF GLOBAL AGRICULTURAL INFORMATION WHO ARE THEY?

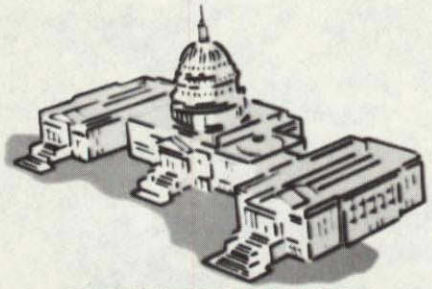


FARM-RELATED MANUFACTURING

- MARKET ANALYSIS
- DECISION NEEDS
- POLICY FORMULATION
- RESOURCE UTILIZATION
- TECHNOLOGY DEVELOPMENT



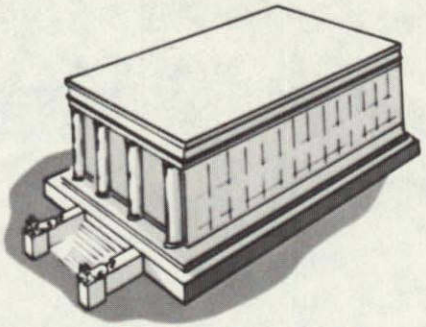
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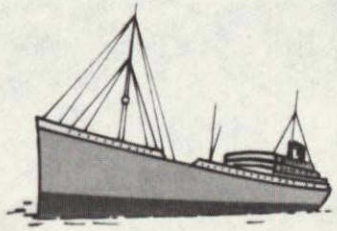
GOVERNMENT



FARM OPERATORS



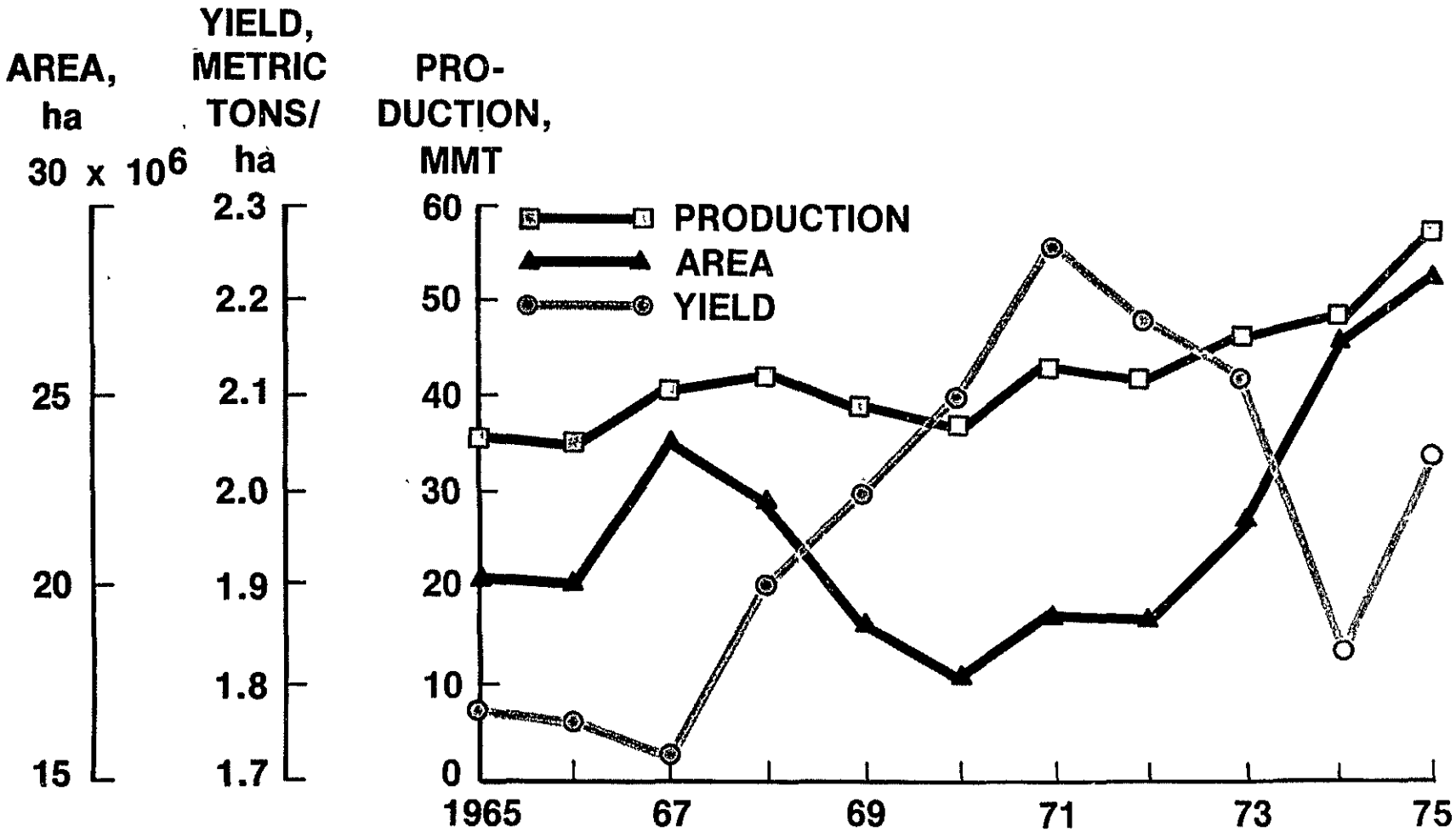
INVESTORS



SHIPPING/RAIL TRANSPORTATION

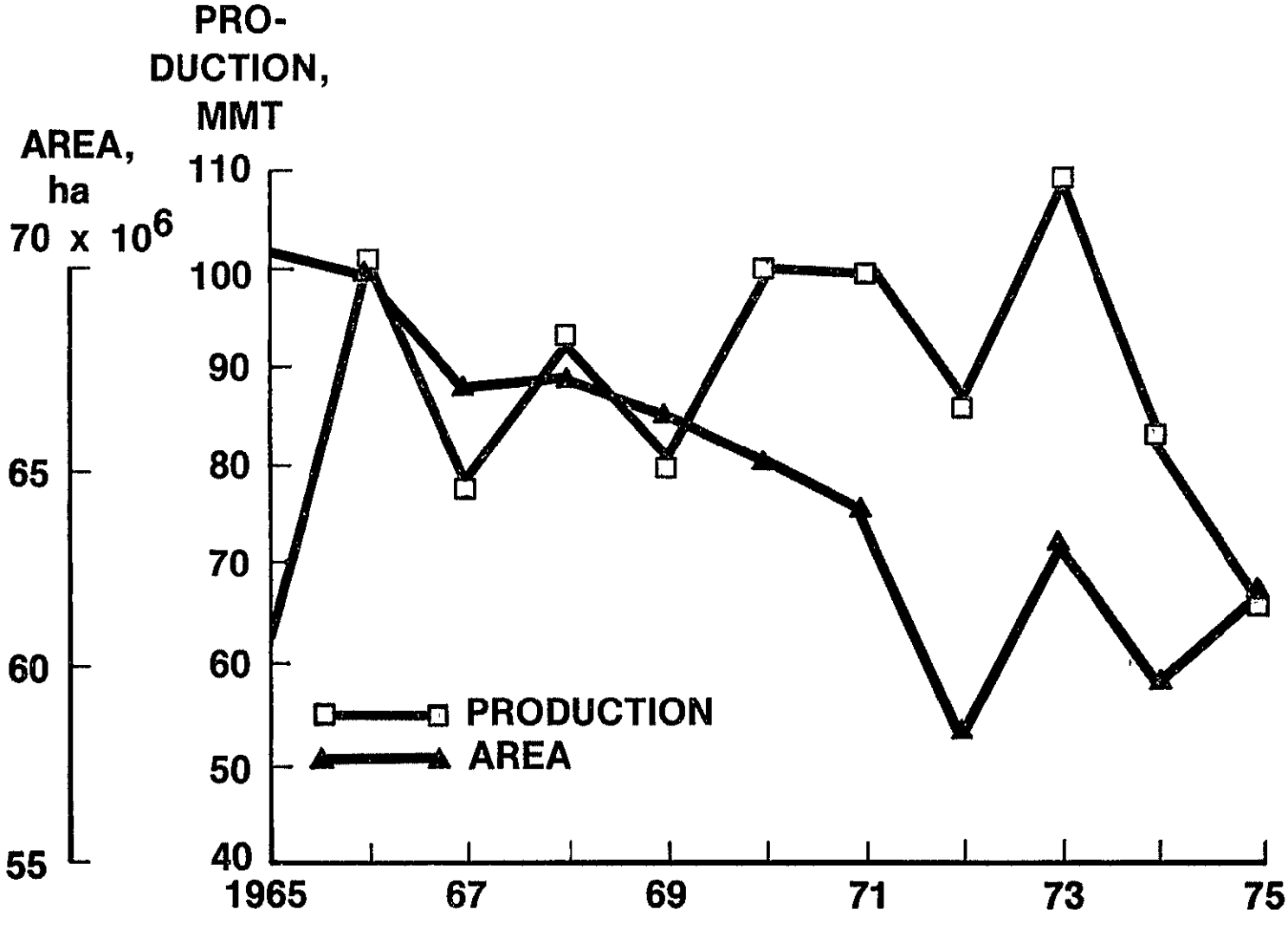
NASA-S-78-16043

U.S. TOTAL WHEAT PRODUCTION COMPONENTS VARIABILITY



NASA-S-78-16044

U.S.S.R. TOTAL WHEAT PRODUCTION COMPONENTS VARIABILITY



NASA-S-78 16040

GLOBAL AGRICULTURAL INFORMATION WHAT IS NEEDED?

OF PRIMARY INTEREST IS INFORMATION RELATED TO NEW CROP EXPECTATIONS SHAPED BY ECONOMIC VARIABLES, GOVERNMENT POLICY, WEATHER

FIRST TWO QUARTERS - IMPROVED ACREAGE INFORMATION

LAST TWO QUARTERS - IMPROVED YIELD FORECASTS

YIELD FORECAST

HARVEST YIELD

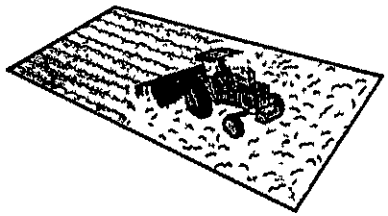


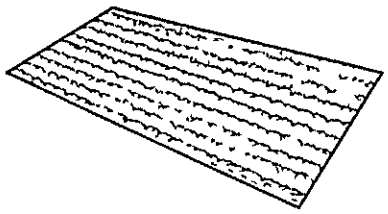
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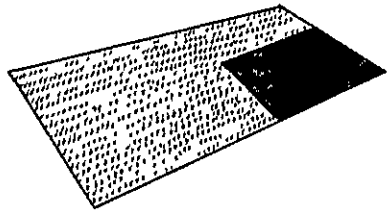
STANDING AREA

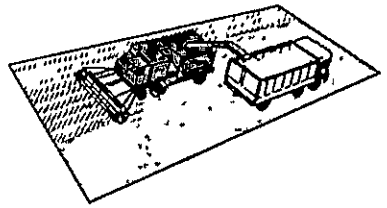
CURRENT TEMP AND PRECIP

ABANDONMENT









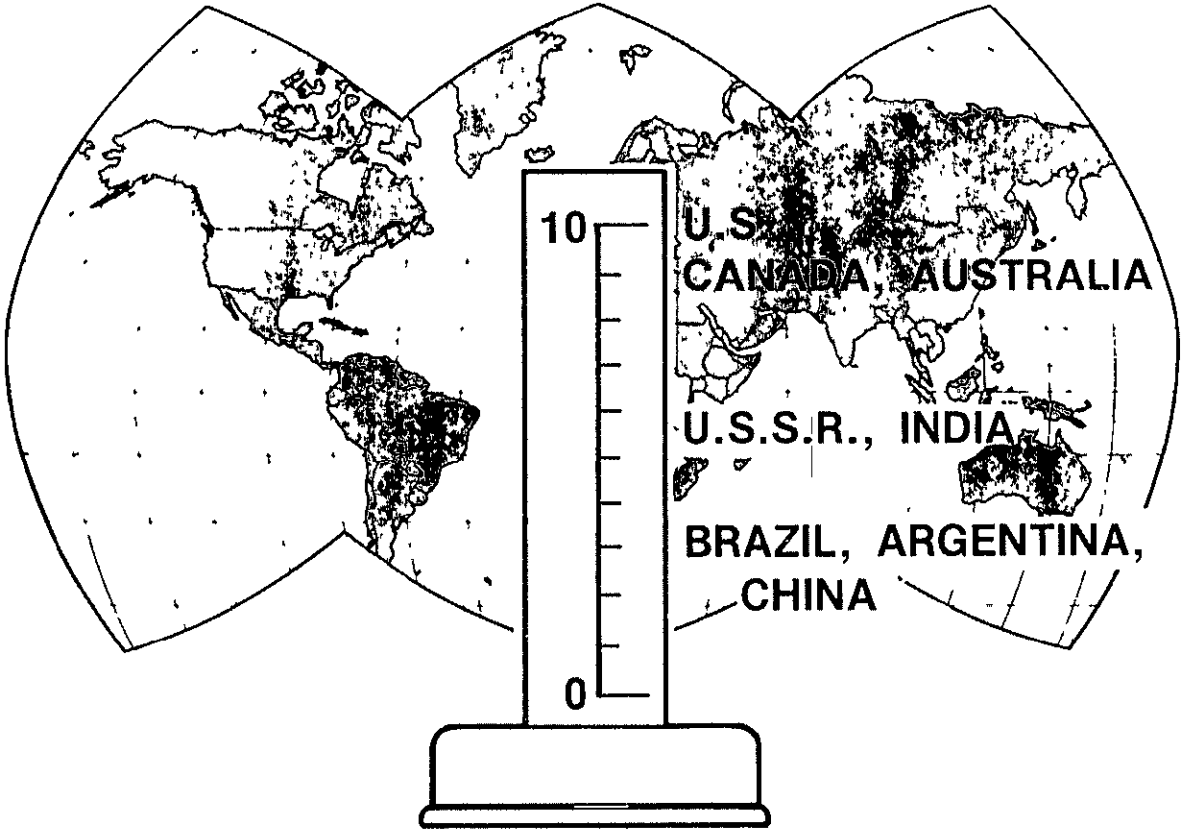
PRESEASON

EARLY SEASON

MIDSEASON

AREA HARVESTED

PRESENT GLOBAL AGRICULTURAL INFORMATION SYSTEMS
HOW WELL DO THEY WORK?



ACCURATE, TIMELY INFORMATION

NO TIMELY REPORTING, UNKNOWN RELIABILITY

LITTLE OR NO INFORMATION

DESIRABLE CHARACTERISTICS - TIMELINESS, ACCURACY

NASA-S-79-10263

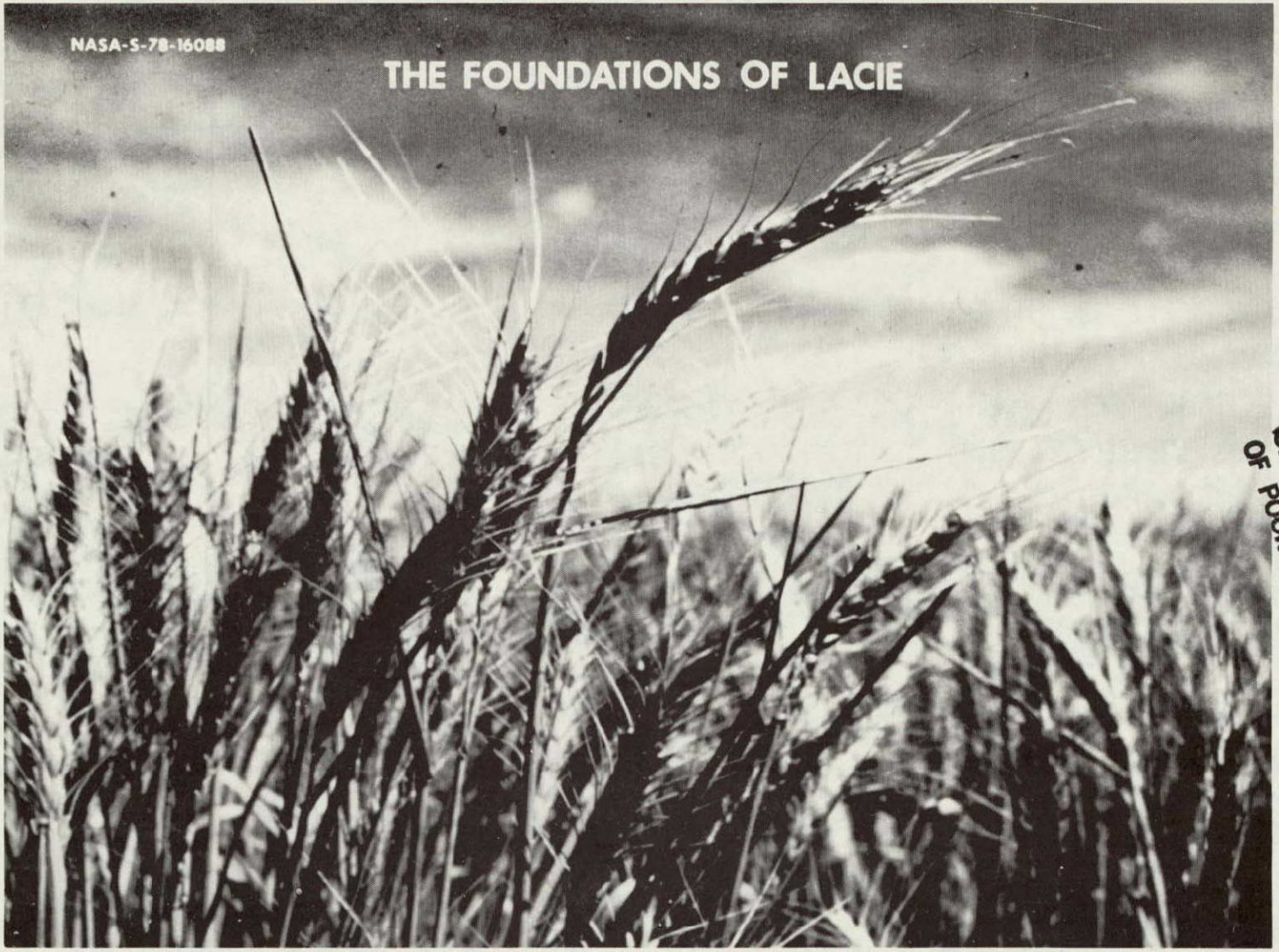
ACCURACY OF USDA WORLDWIDE WHEAT PRODUCTION ESTIMATES

COUNTRY	YEARS OF RECORD	EARLY SEASON	MID-SEASON	AT HARVEST
UNITED STATES	1966-75	–	10 OF 10	10 OF 10
AUSTRALIA	1966-75	5 OF 10	8 OF 10	10 OF 10
CANADA	1966-75	–	9 OF 10	9 OF 10
U.S.S.R.	1973-75	0 OF 3	0 OF 3	1 OF 3
INDIA	1970-75	3 OF 5	3 OF 6	4 OF 5
BRAZIL	1971-75	3 OF 5	3 OF 5	4 OF 5
ARGENTINA	1969-75	2 OF 7	4 OF 7	4 OF 7

PLENARY PRESENTATION NO. 3

THE FOUNDATIONS OF LACIE

R MacDonald, JSC

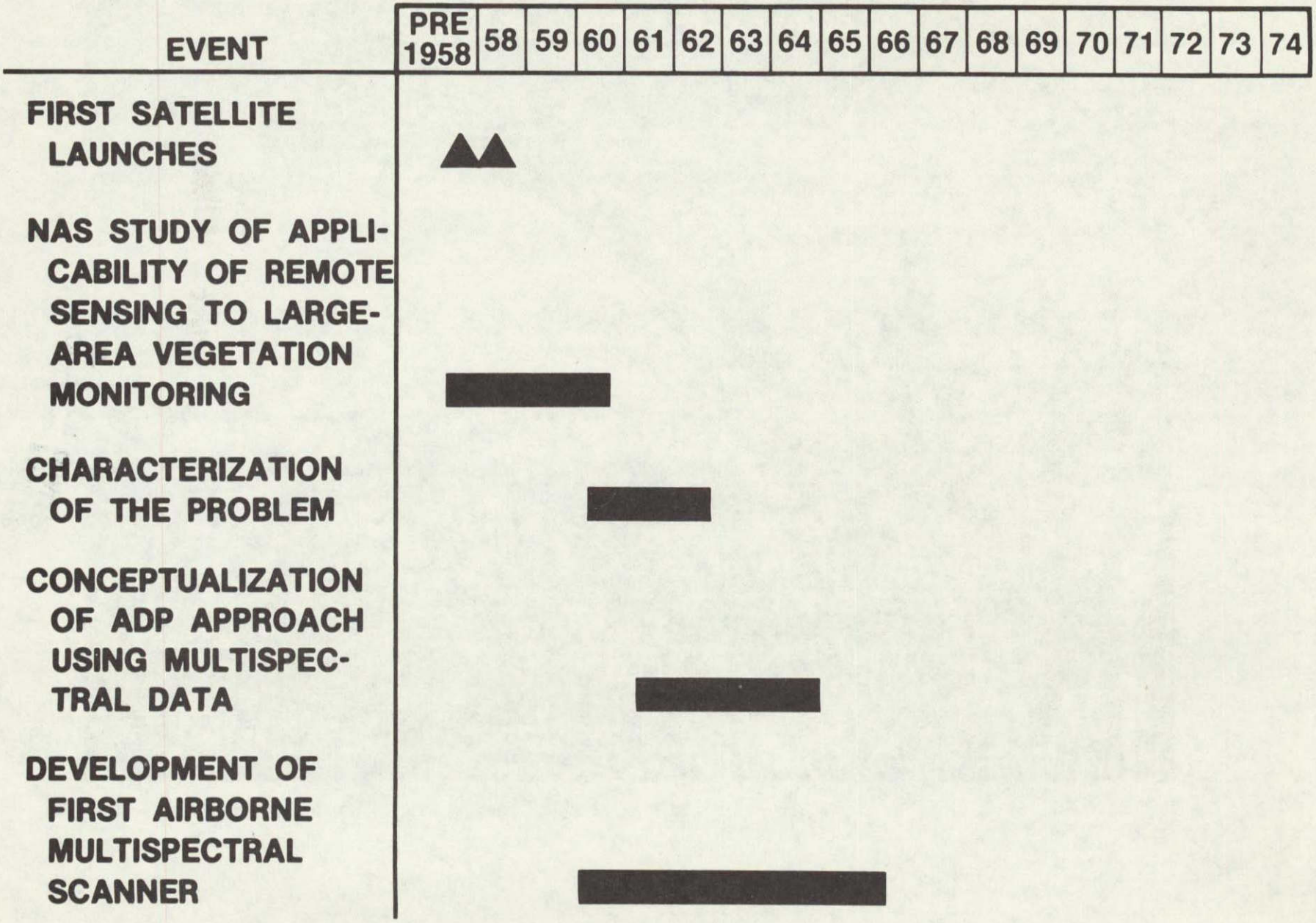


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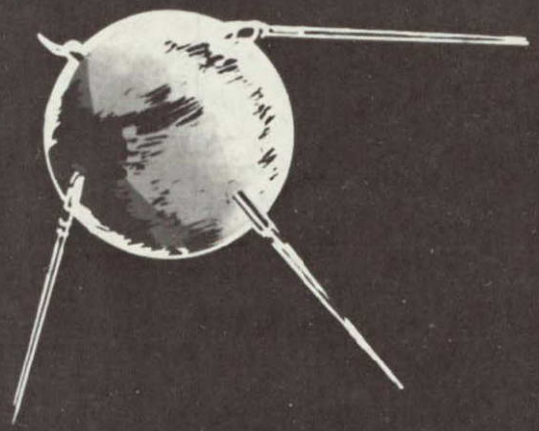
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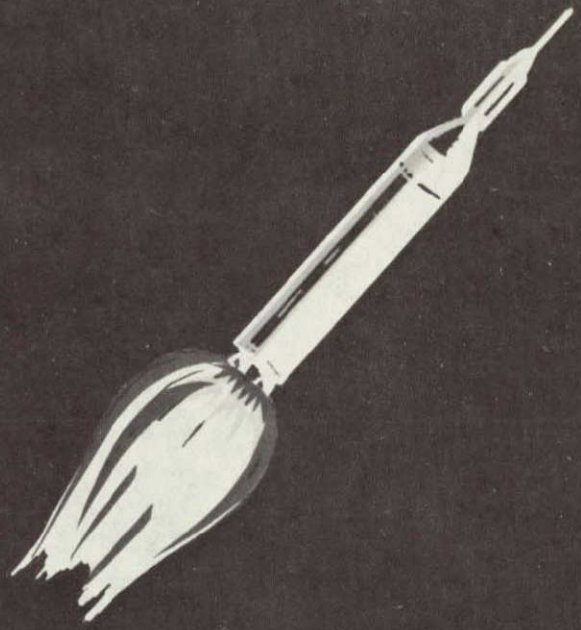
THE FOUNDATIONS OF LACIE



NASA-S-78-16070

VEHICLES CAPABLE OF CARRYING SENSORS PROVIDING GLOBAL COVERAGE





U.S.S.R., SPUTNIK
OCTOBER 4, 1957

U.S., EXPLORER I
JANUARY 31, 1958

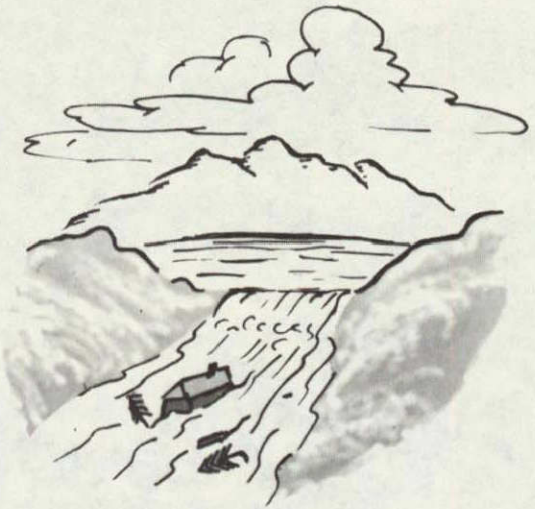
NASA-S-78-16056

FOCUS OF ATTENTION ON POSSIBLE APPLICATION NEEDS

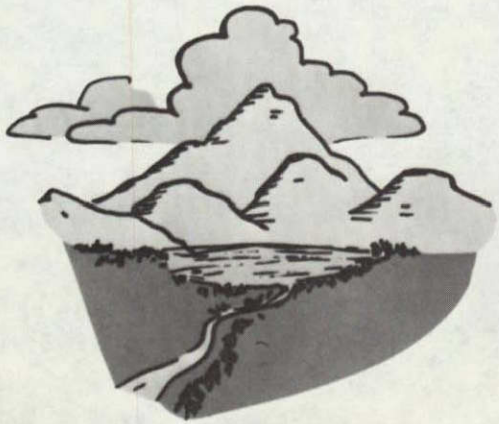


CROPS

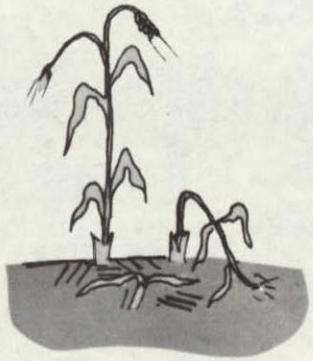




FLOODS



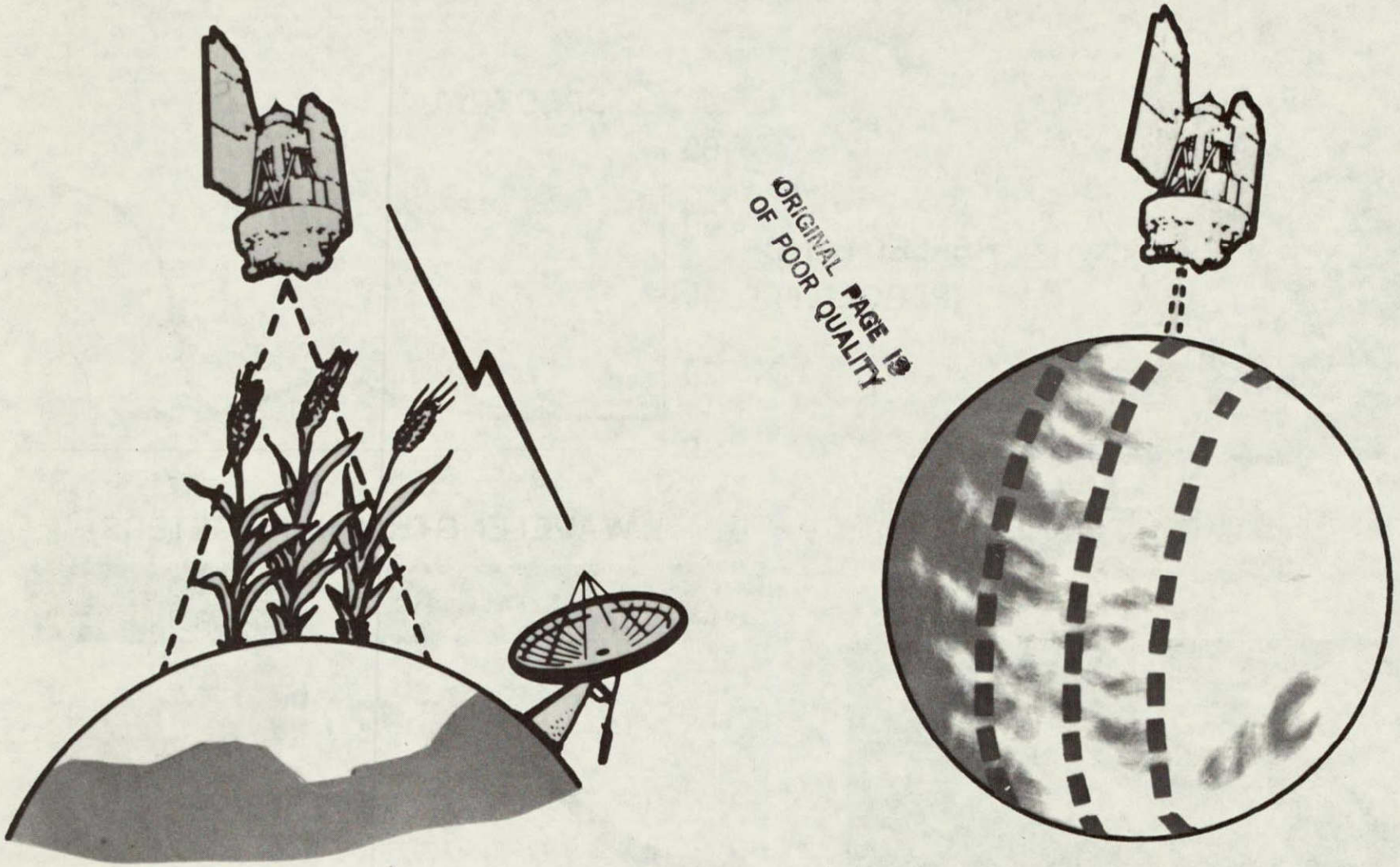
LAND RESOURCES



DROUGHT

NASA-S-78-16087

RECOGNITION OF NEED FOR REPETITIVE, GLOBAL, TIMELY CROP INFORMATION



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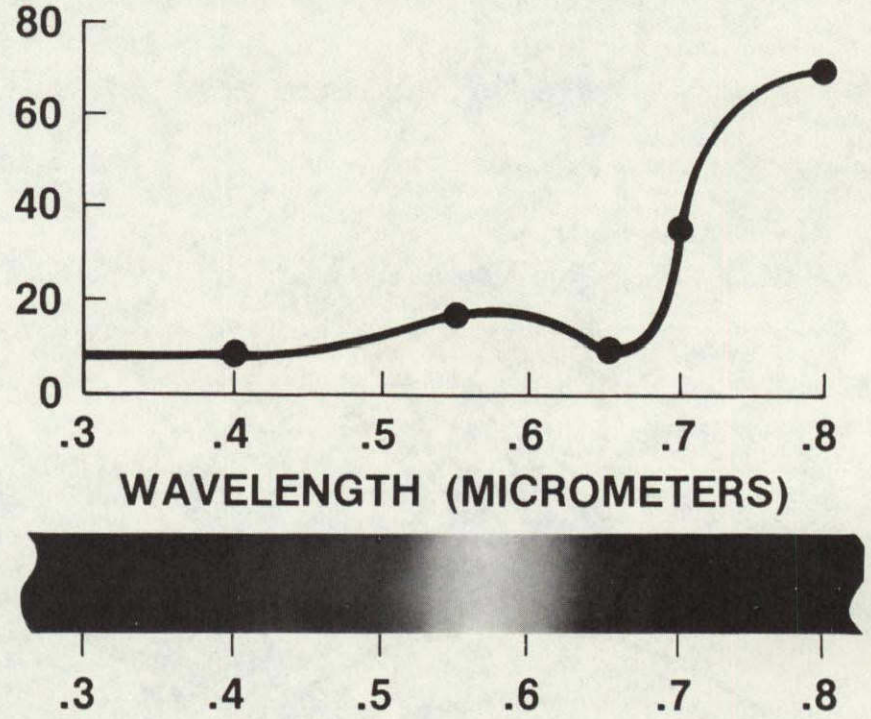
DEVELOPMENT OF WORKING AUTOMATIC DATA PROCESSING CONCEPT

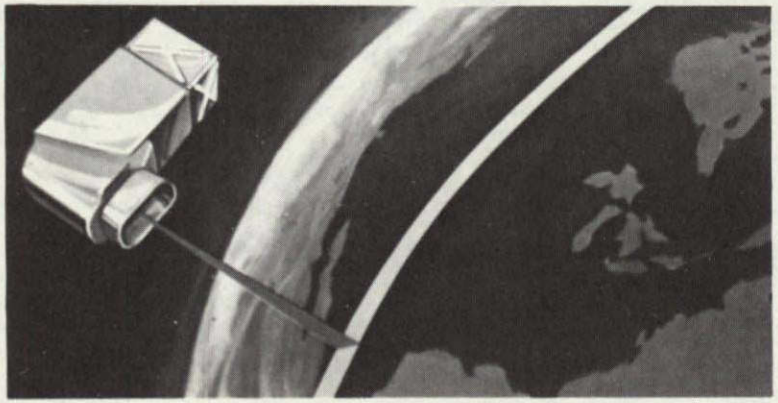
SPATIAL



?

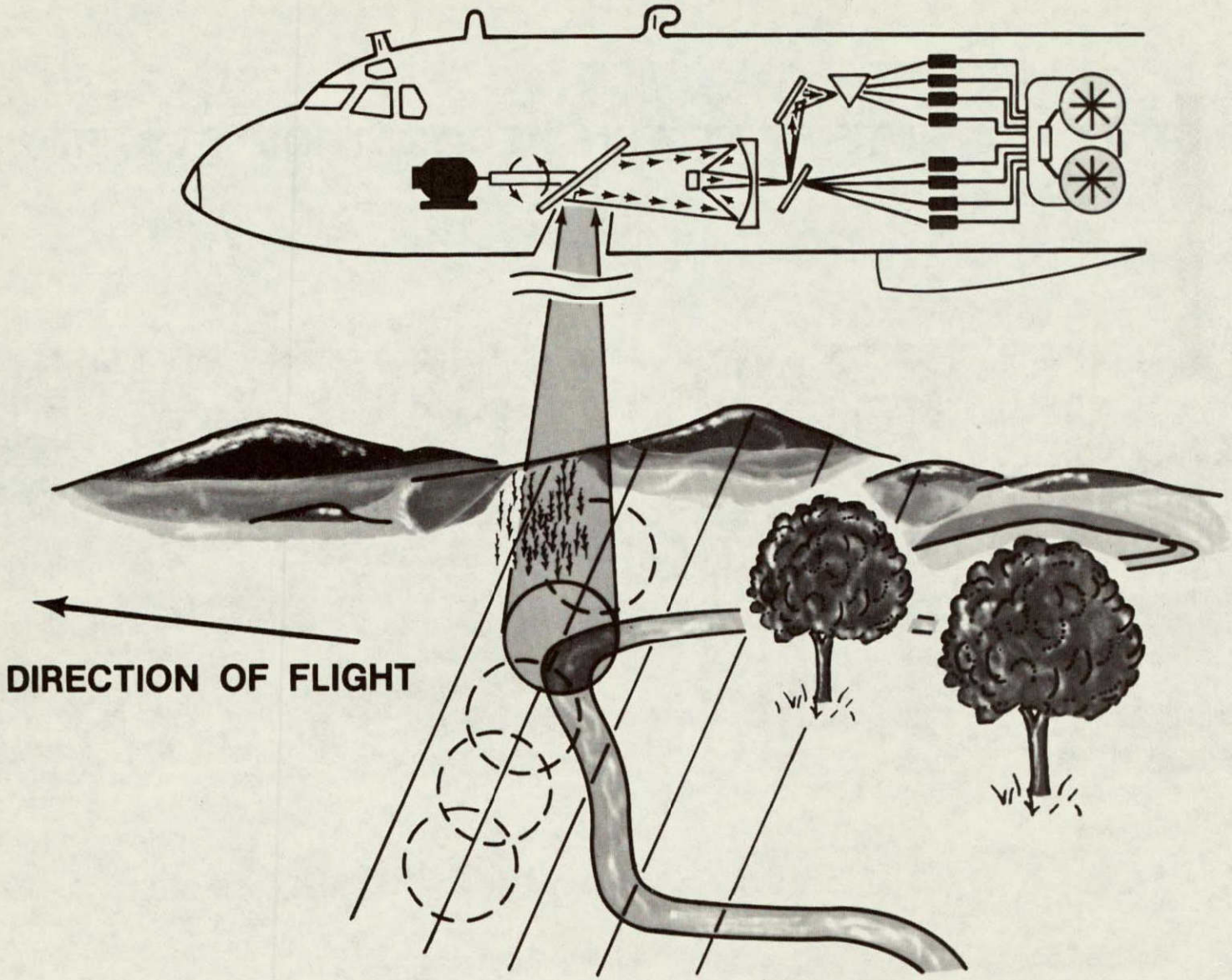
SPECTRAL





NASA-S-78-16048

DATA AVAILABLE TO SUPPORT THE ADP APPROACH

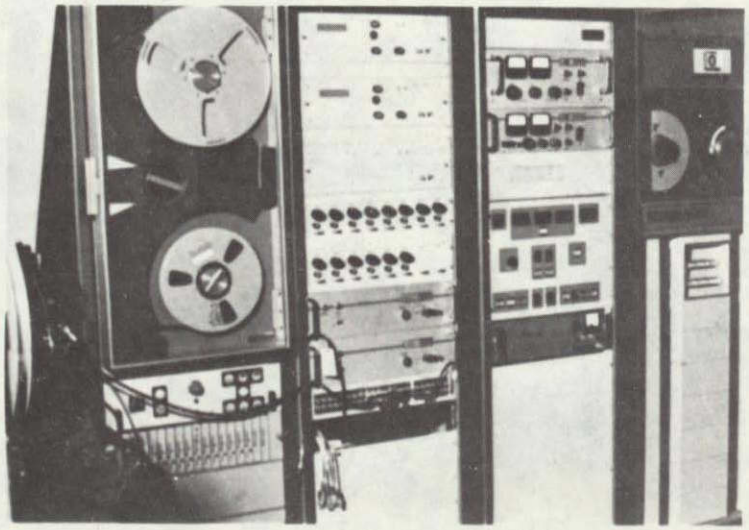


NASA National Aeronautics and Space Administration

NASA-S-78-16085

Lyndon B. Johnson Space Center
Houston, Texas 77058

DIGITAL COMPUTER PATTERN RECOGNITION SYSTEM

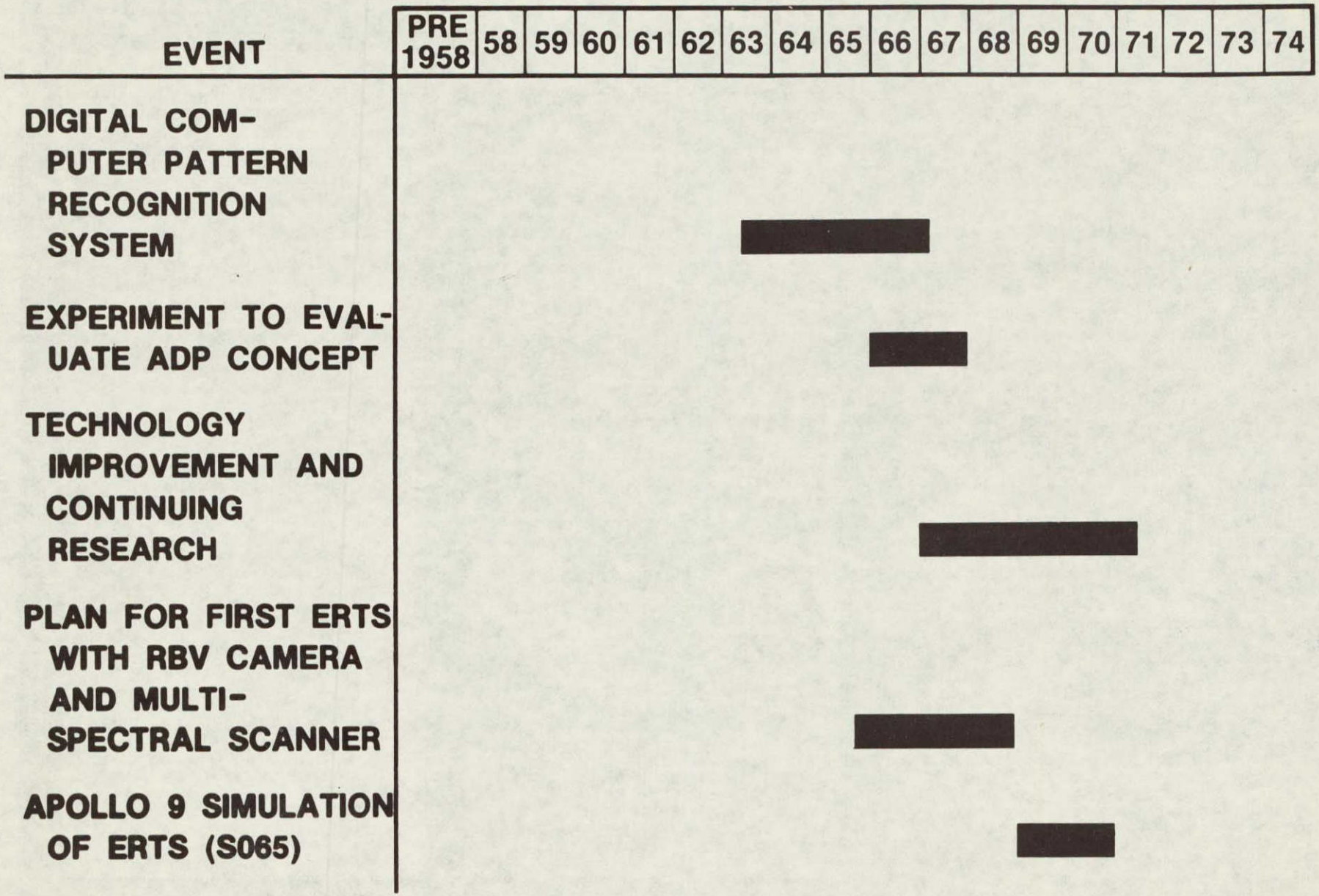




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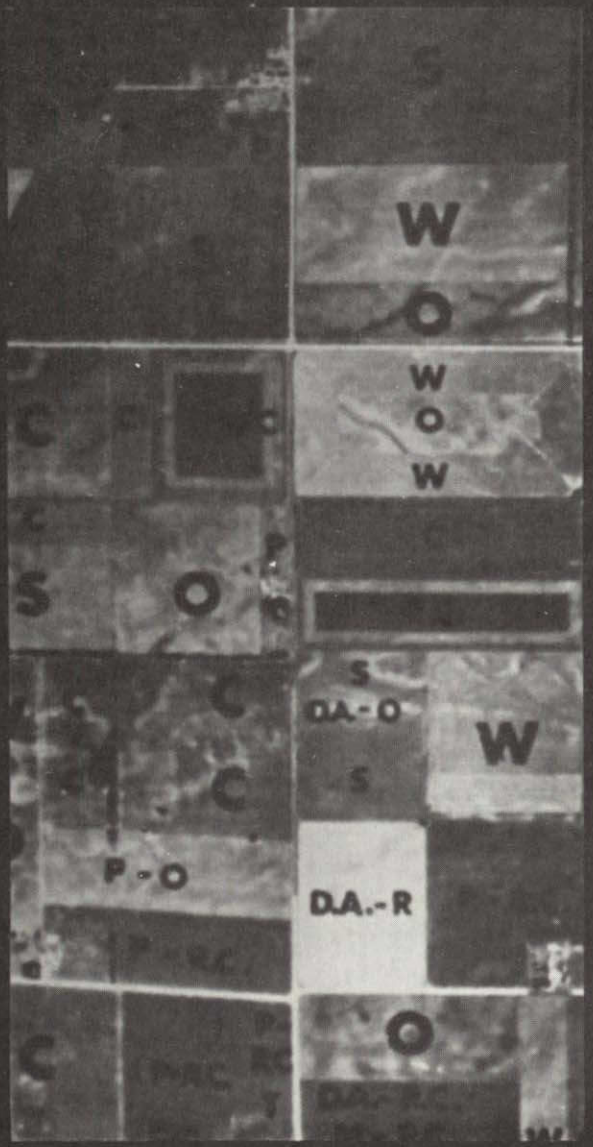
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THE FOUNDATIONS OF LACIE (CONT)

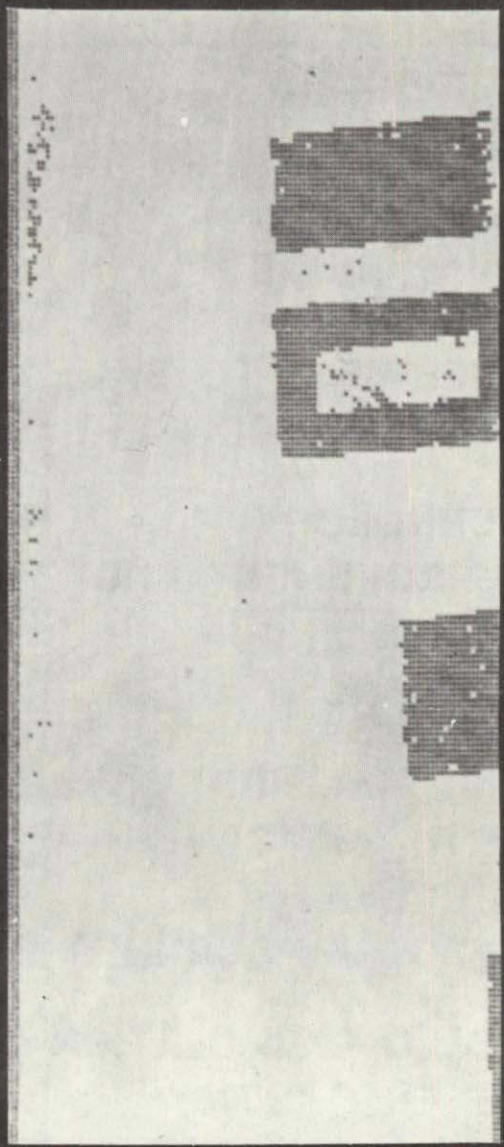


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VERIFICATION OF SCANNER/ADP APPROACH OVER LARGE AREAS







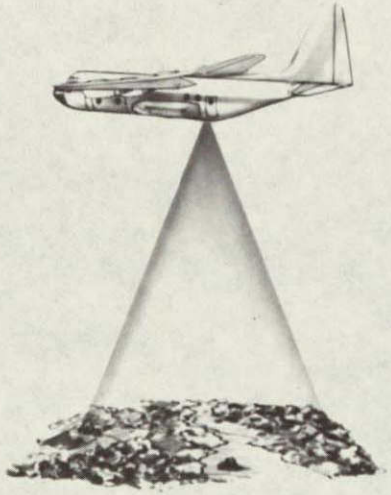
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IMPROVED CAPABILITY, IMPROVED UNDERSTANDING OF BASIC PHENOMENA AND EXPANDED TEST AND EVALUATION TO MORE SITUATIONS

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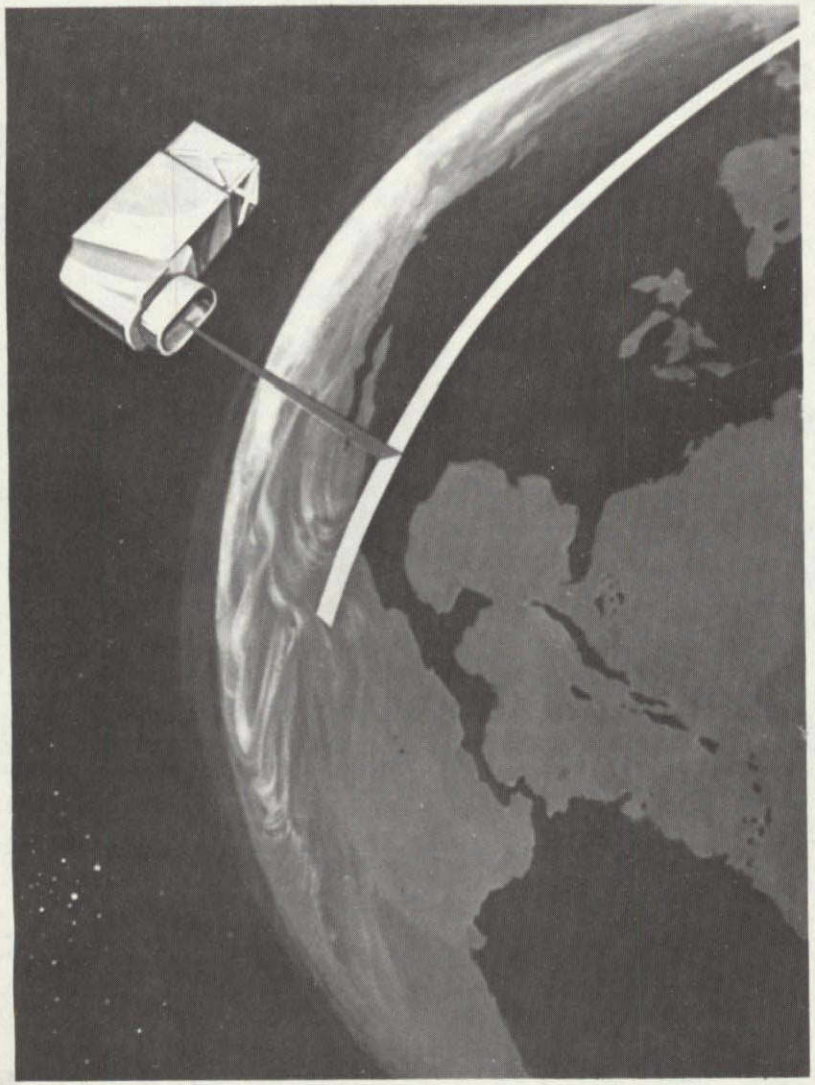


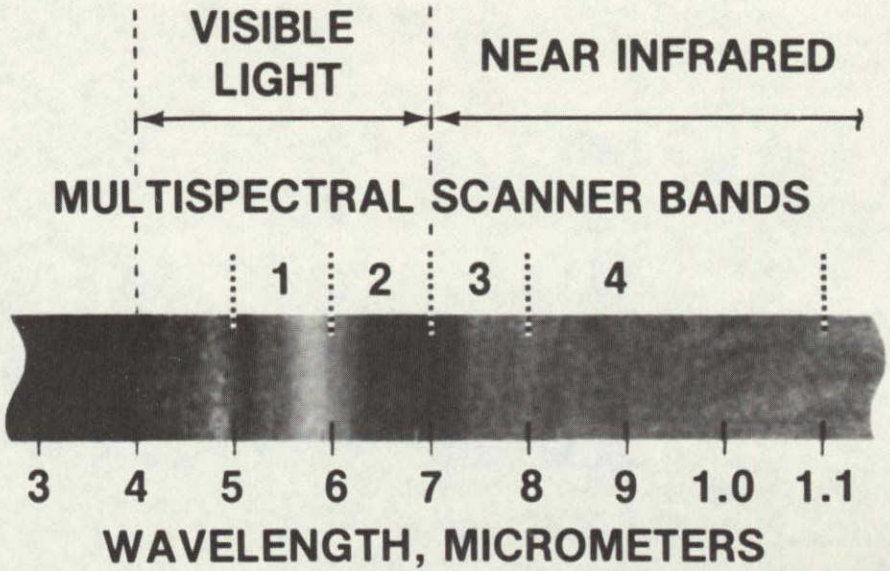




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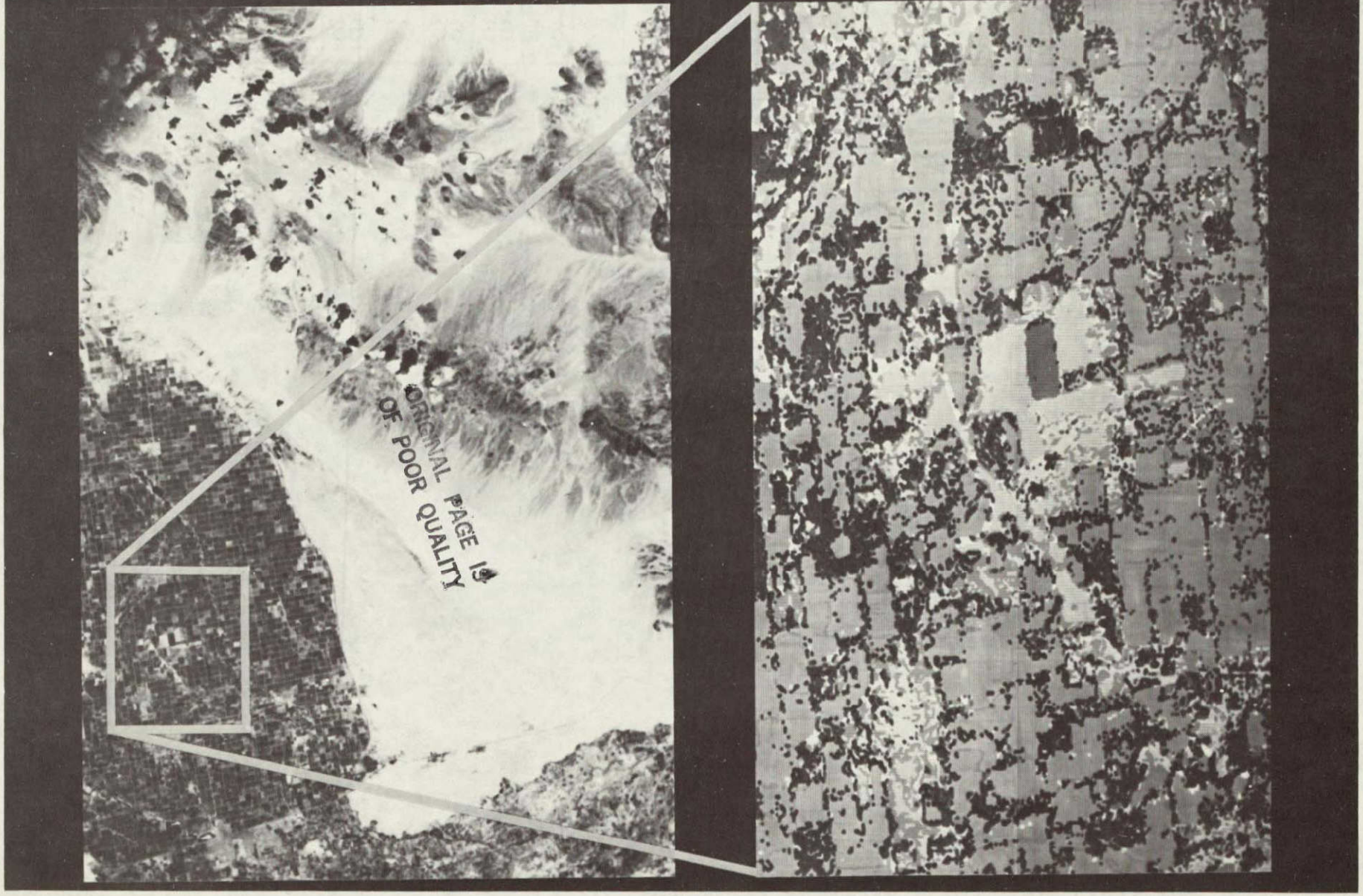
SPECIFICATION FOR FIRST SPACEBORNE MULTISPECTRAL SCANNER



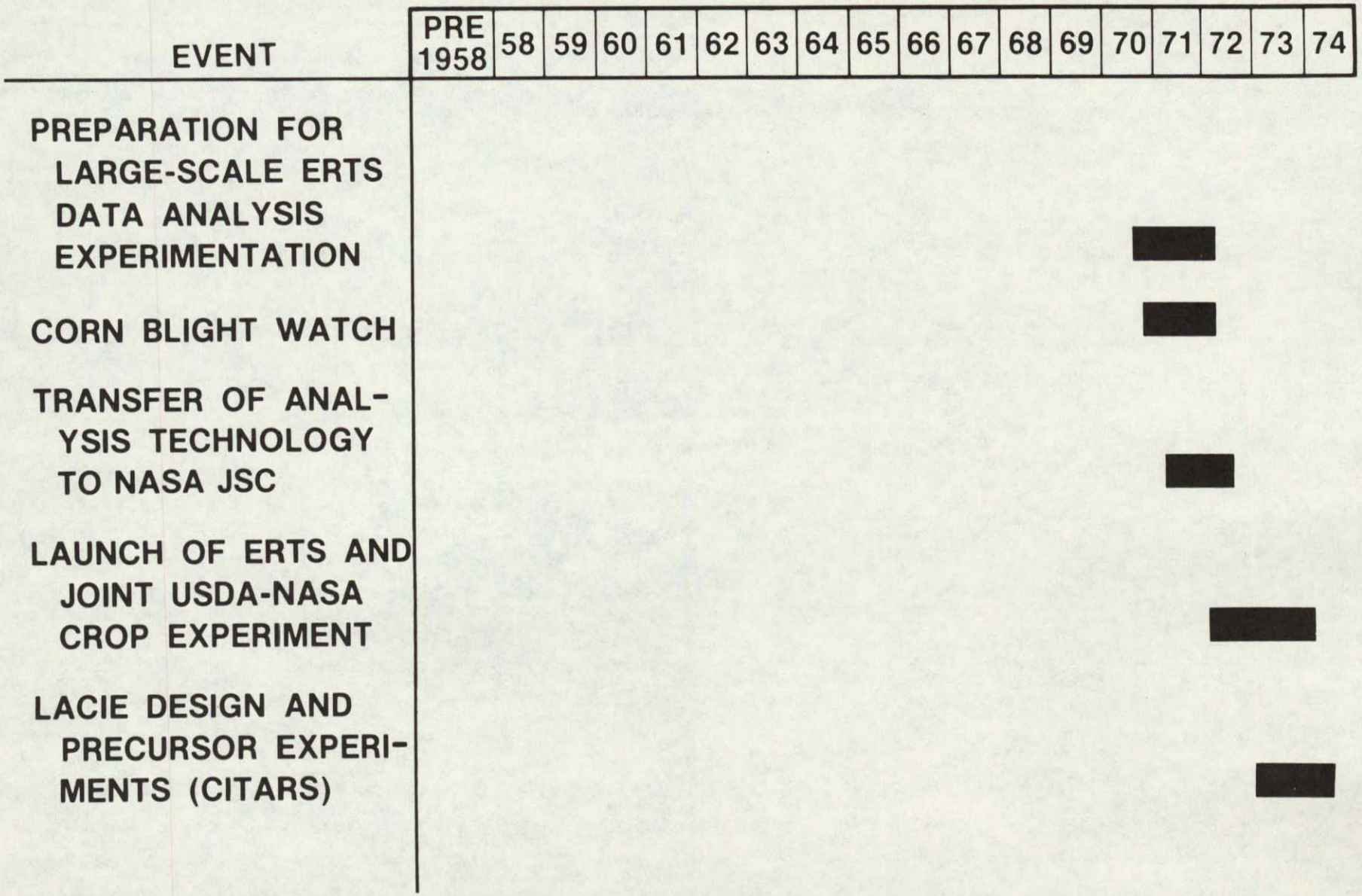


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REALIZATION THAT SIMPLE BANDS AND COARSE RESOLUTION OF ERTS WOULD BE USEFUL IN AGRICULTURE

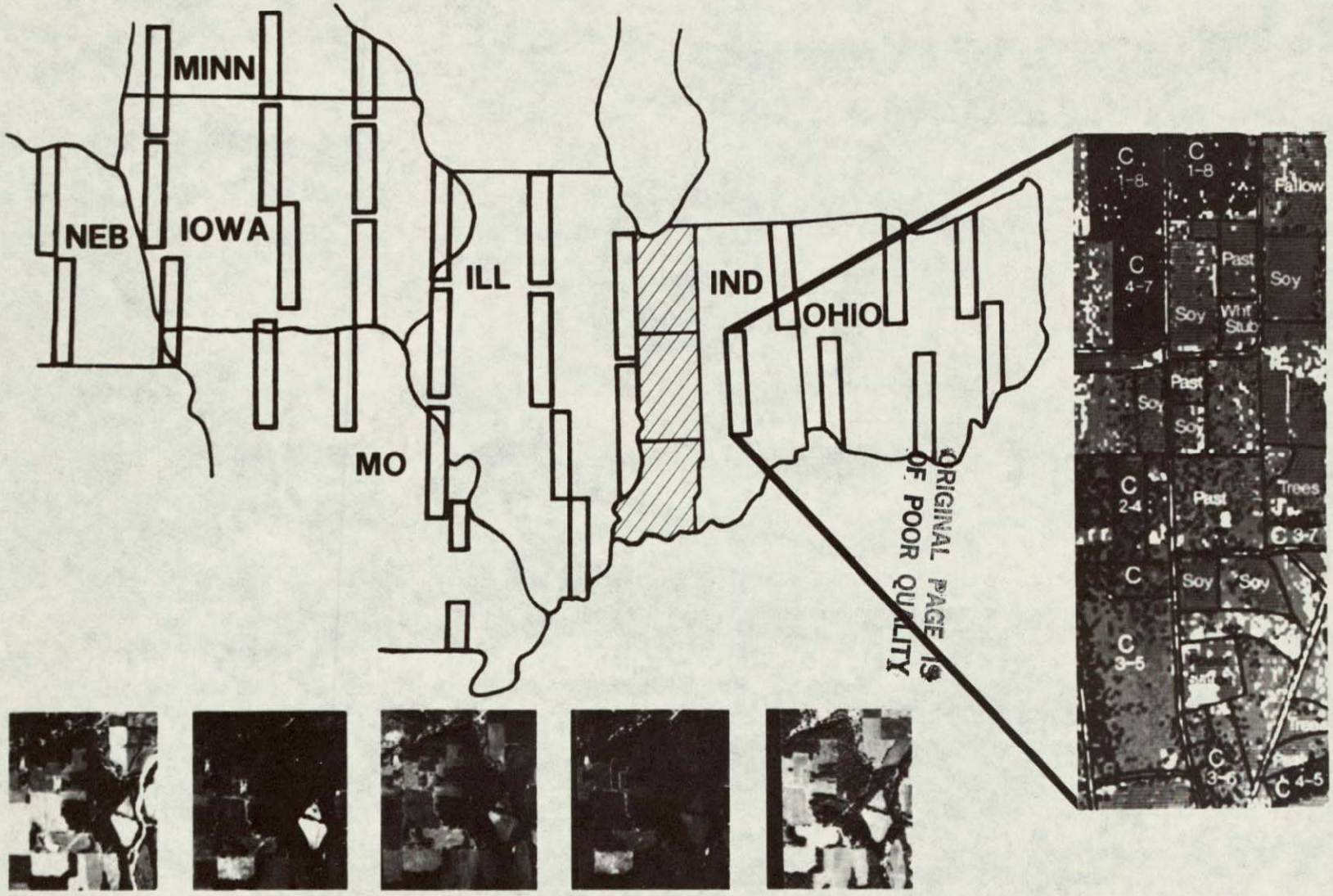


THE FOUNDATIONS OF LACIE (CONT)



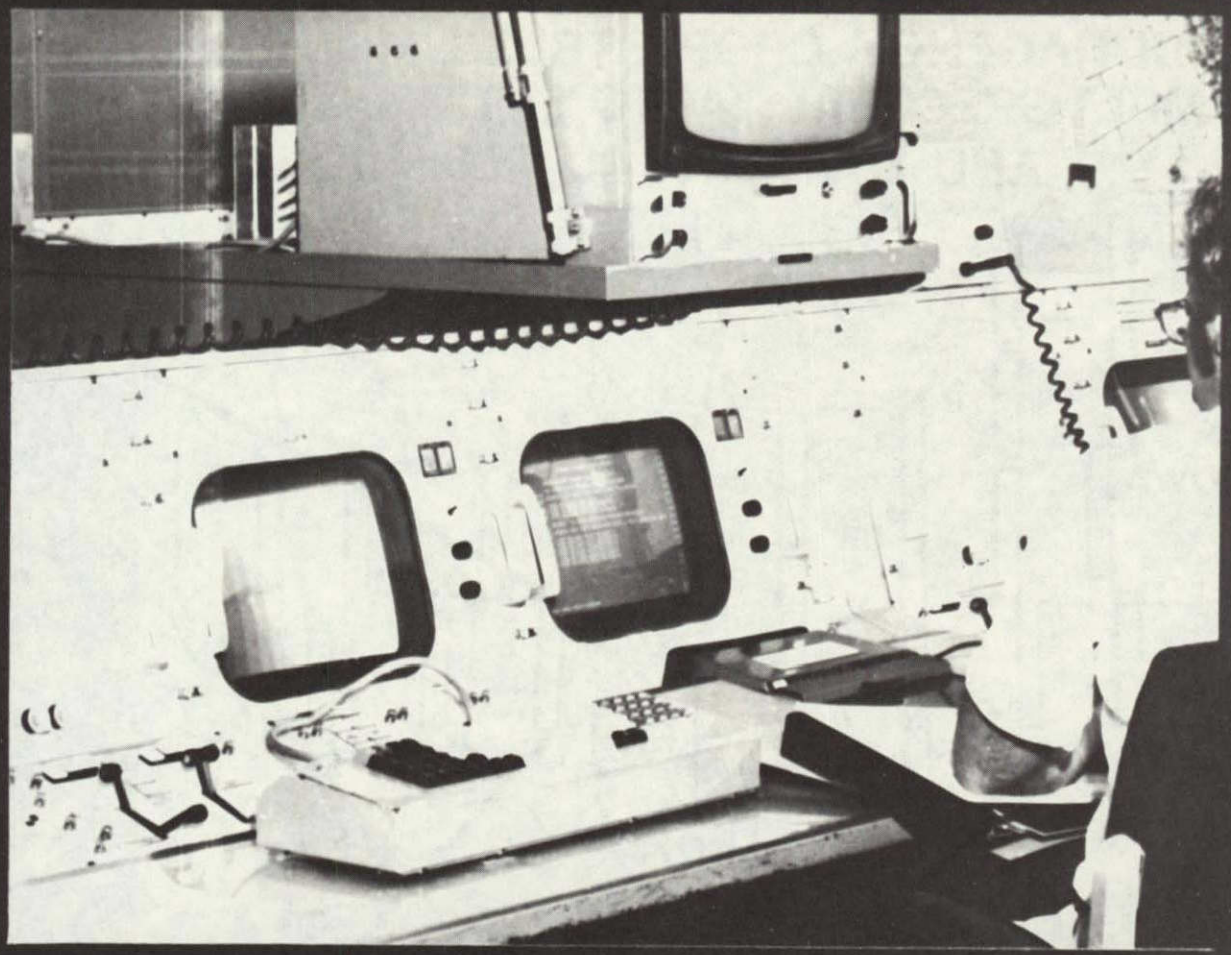
NASA-S-78-16492

FIRST MULTIAGENCY CROP STRESS MONITORING EFFORT USING MULTISPECTRAL, AUTOMATIC DATA PROCESSING, AND STATISTICAL TECHNIQUES



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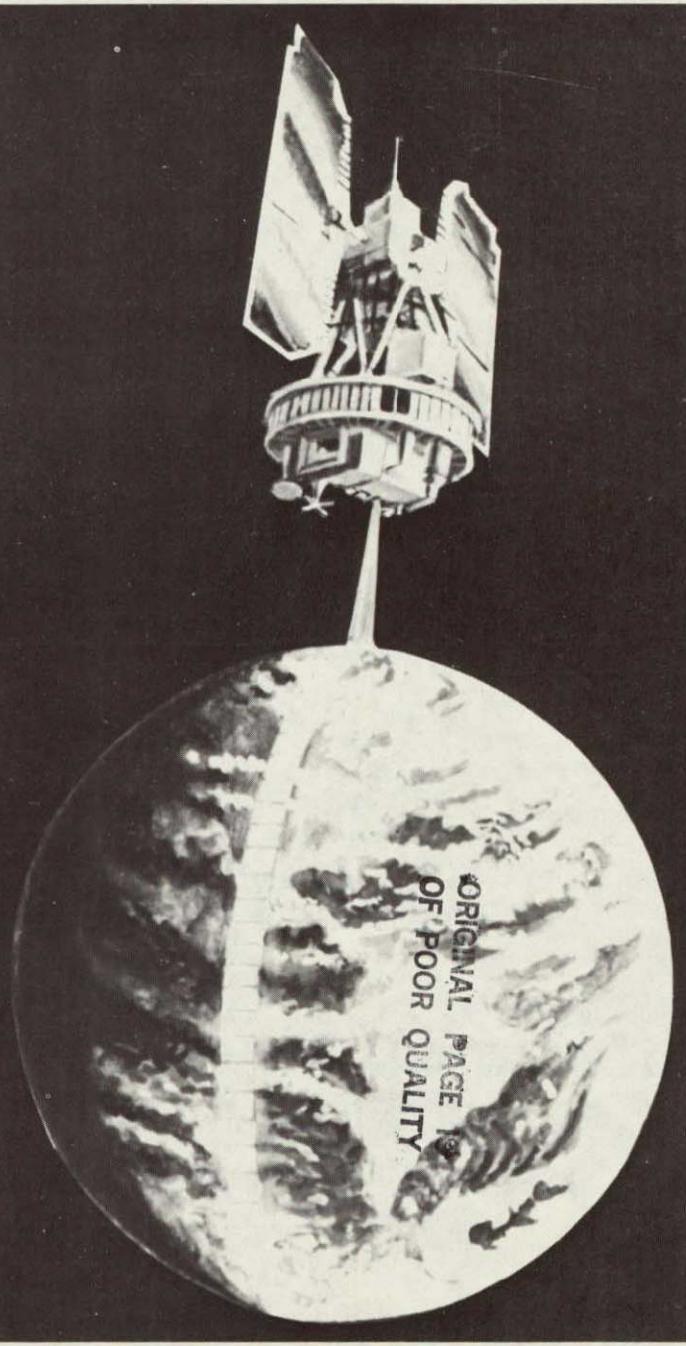
NASA-S-78-16102



- CURSORY EVALUATION OF DISCIPLINE-ORIENTED APPLICATIONS
- EVALUATE JSC COMPUTER-AIDED AND IMAGE INTERPRETIVE DATA FACILITIES
- DEFINE AND DEVELOP ANALYSIS TECHNIQUES AND PROCEDURES
- FAMILIARIZATION AND ORIENTATION OF ANALYSIS TEAM

NASA S-78-16047

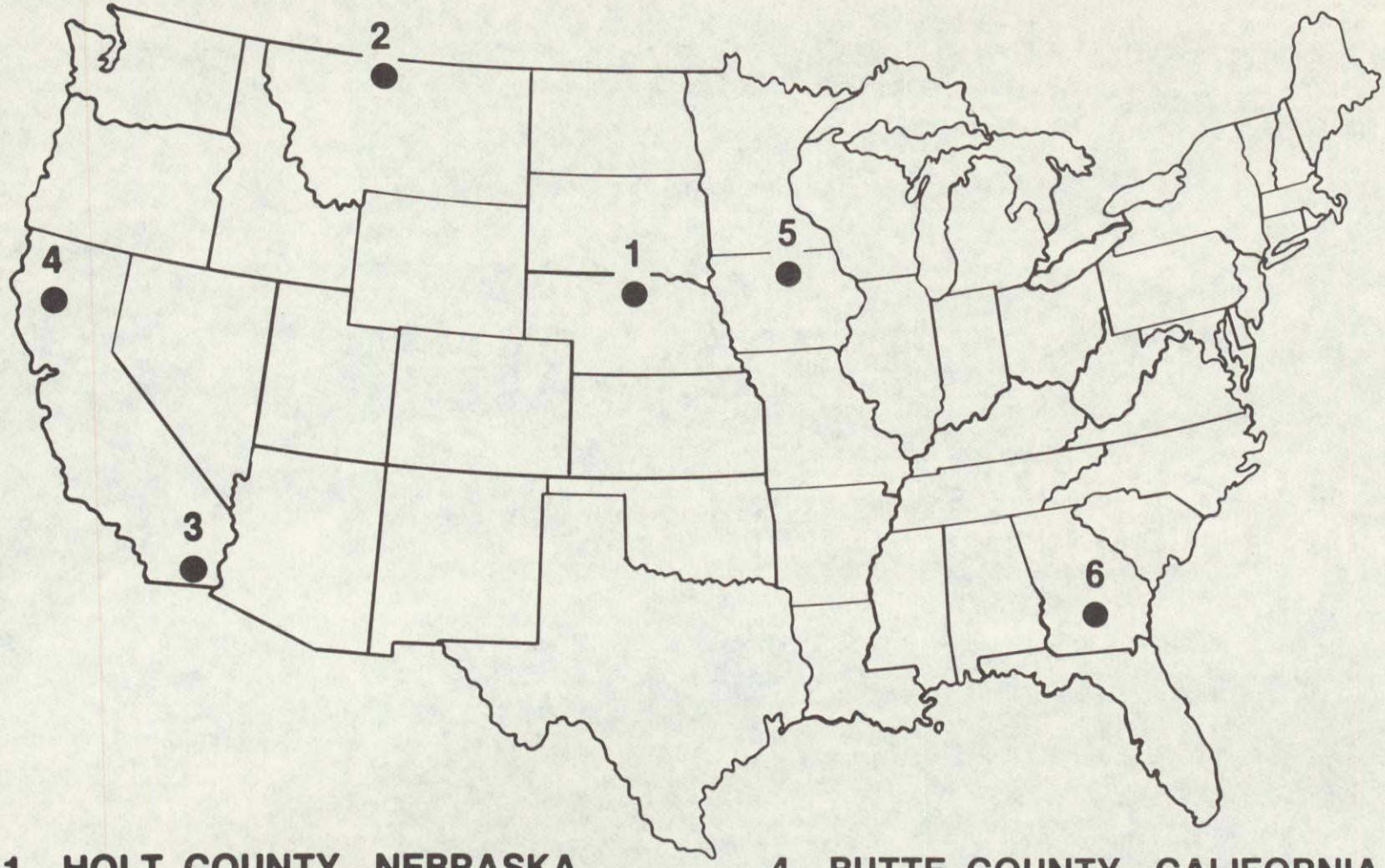
GLOBAL COVERAGE WITH MULTISPECTRAL DATA



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NASA-S-78-16089

ERTS-1 ACSC TEST TARGET COUNTIES



1 HOLT COUNTY, NEBRASKA
2 HILL COUNTY, MONTANA
3 IMPERIAL COUNTY, CALIFORNIA
4 BUTTE COUNTY, CALIFORNIA
5 HARDIN COUNTY, IOWA
6 WORTH COUNTY, GEORGIA

NASA-S-73-2855

LANDSAT 1
ASCS
HOLT COUNTY, NEBRASKA



LEGEND: 6 CLASSES

RED	CORN
L. GREEN	HAY GRASS
D. GREEN	PASTURE
ORANGE	SUNFLOWER
PURPLE	ALFALFA
L. PURPLE	ALFALFA AND GRASS
BROWN	BARE SOIL

SUPERVISED COMPUTER CLASSIFICATION MAP 7/30/72

RED	FIELD CORN
YELLOW	POP CORN
ORANGE	SUNFLOWER
L. GREEN	ALFALFA AND GRASS
D. GREEN	PASTURE
BLUE	BROOME
PURPLE	ALFALFA
BROWN	BARE SOIL

TEMPORAL OF 7/30/72 AND 8/16/72



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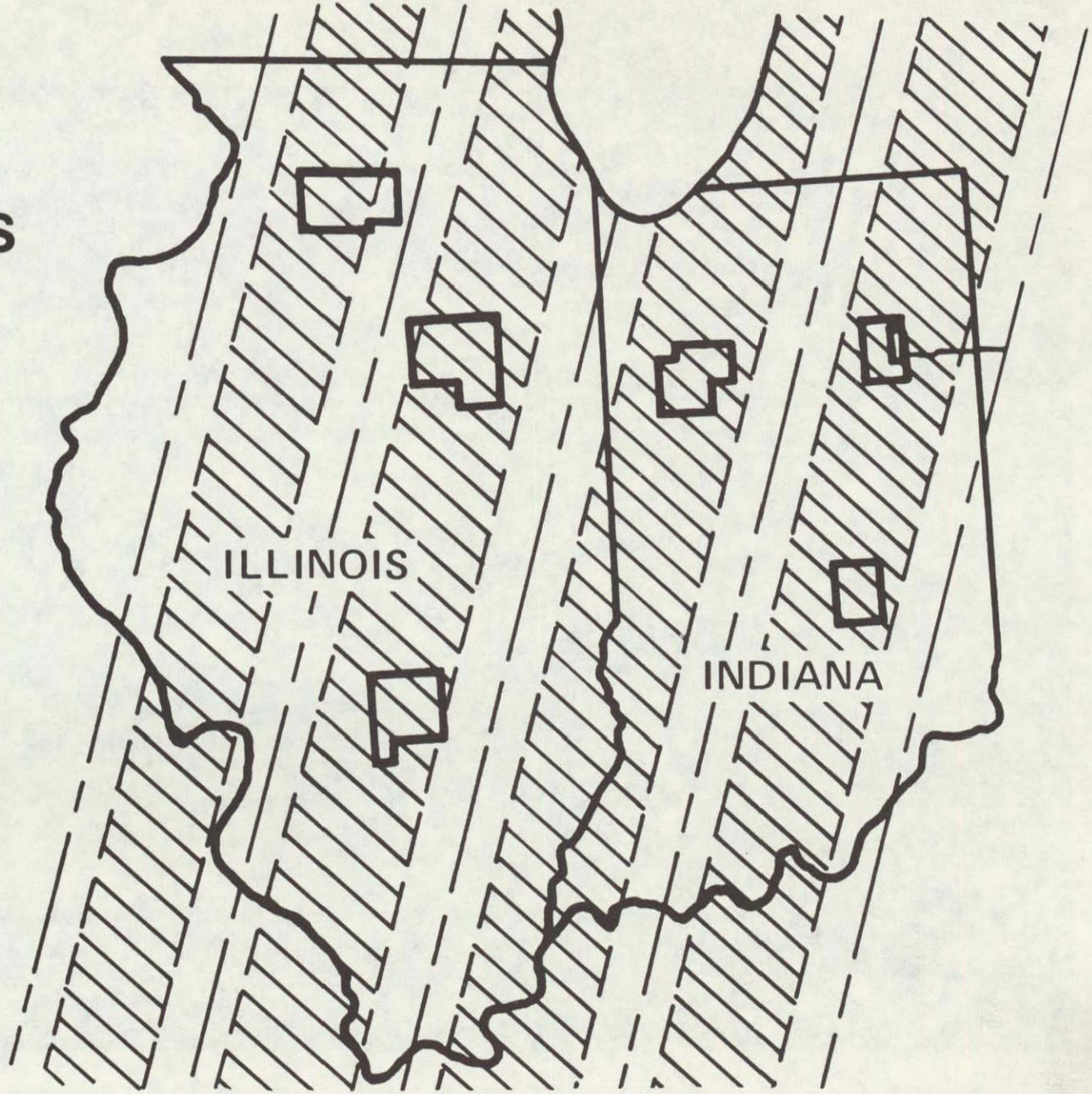
NASA National Aeronautics and Space Administration

Lyndon B. Johnson Space Center
Houston, Texas 77058

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CITARS STUDY AREAS

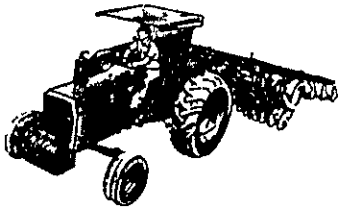
CROP IDENTIFICATION TECHNOLOGY ASSESSMENT FOR REMOTE SENSING - 1973



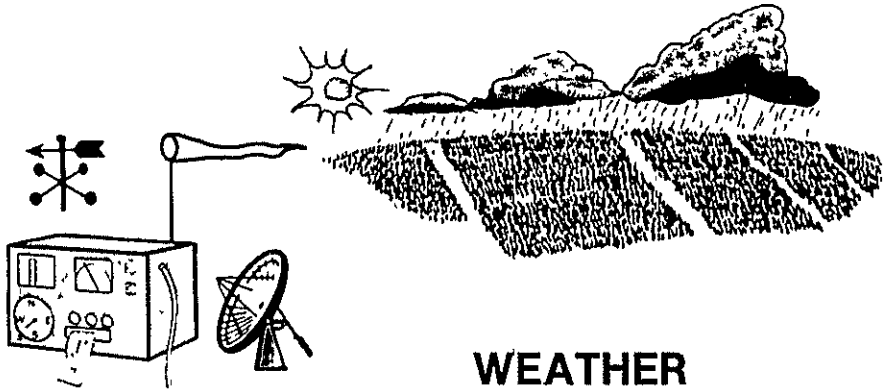
FOUNDATION OF A QUANTITATIVE METHODOLOGY FOR YIELD ESTIMATION



SOILS



TECHNOLOGY



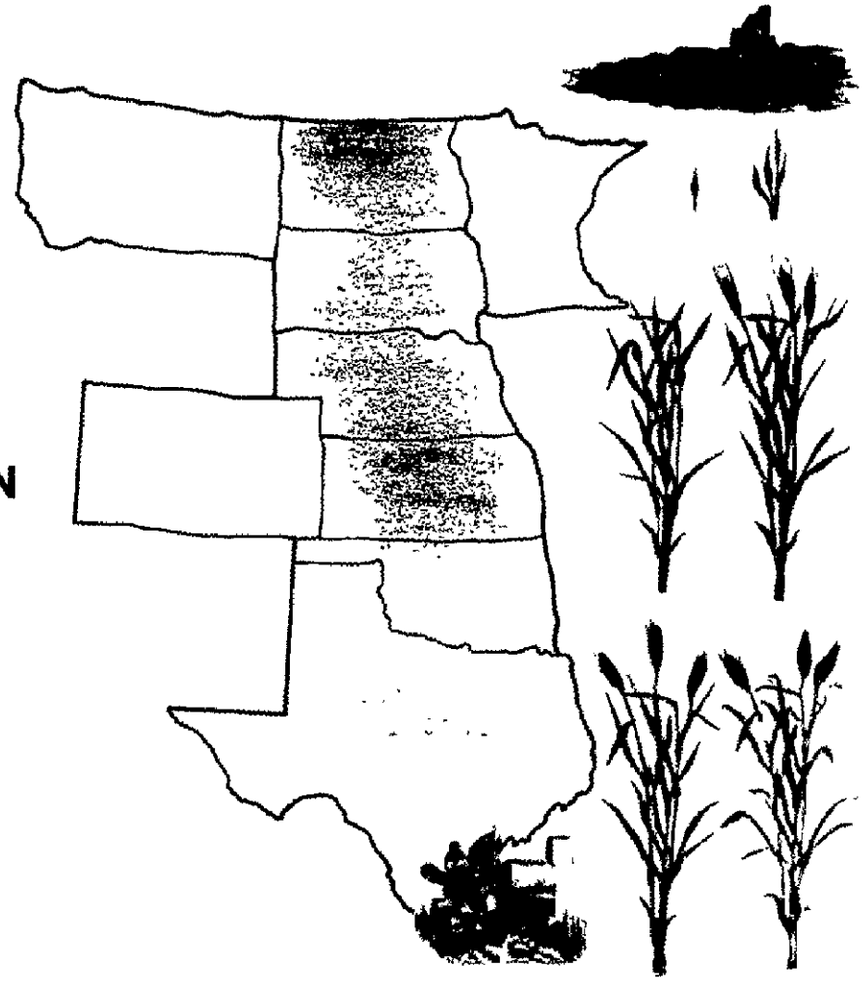
WEATHER

GLOBAL TELECOMMUNICATIONS SYSTEM



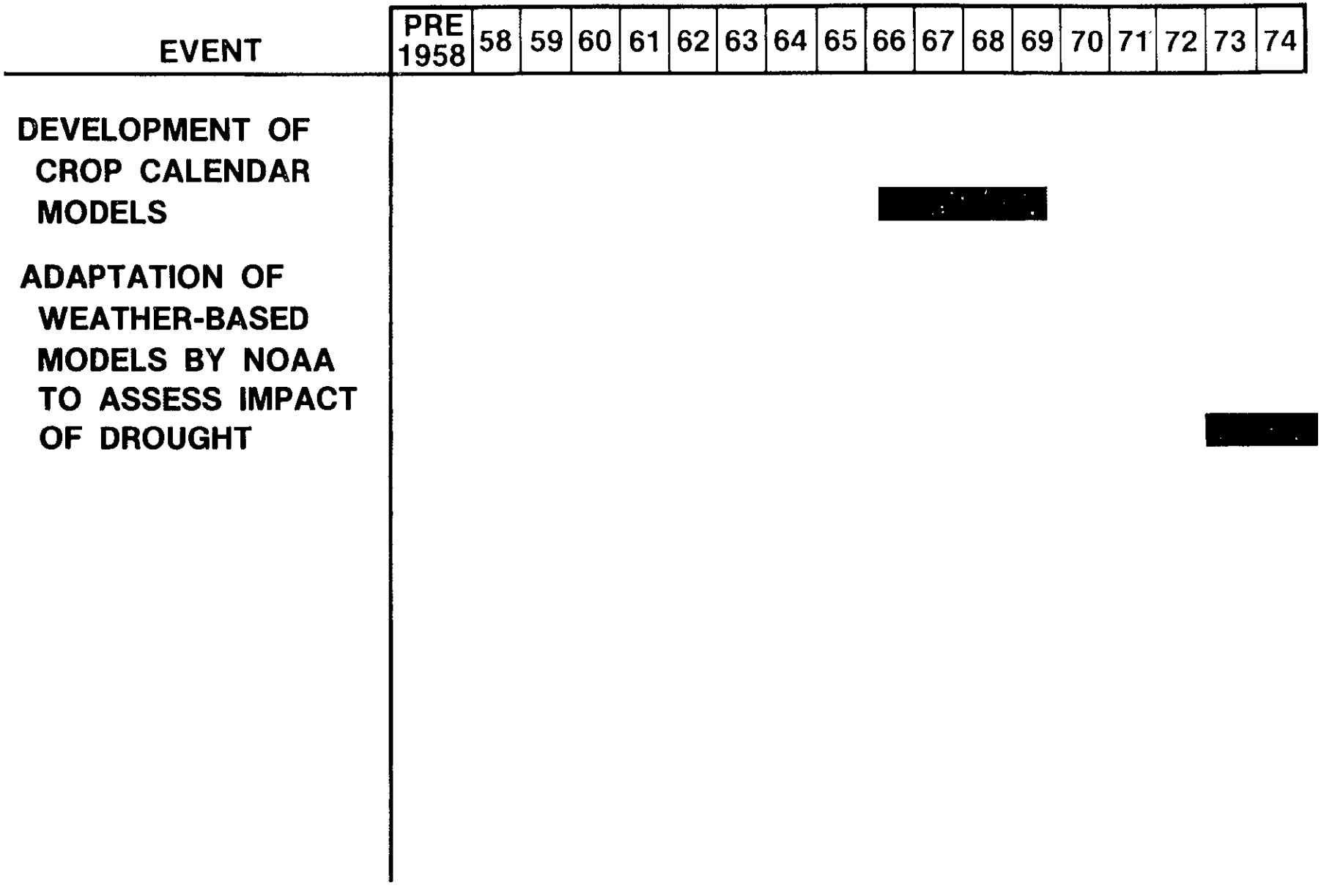
NASA-S-78-16086

QUANTIFIED WEATHER EFFECTS ON PLANT DEVELOPMENT AND APPEARANCE



NASA S 78-17327

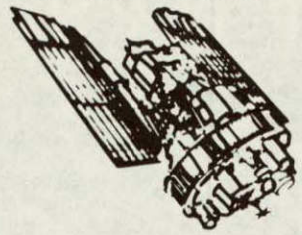
THE FOUNDATIONS OF LACIE (CONT)



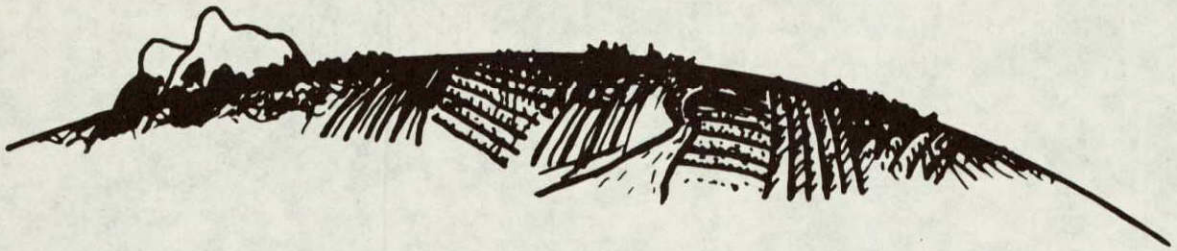
LACIE AS A PROOF-OF-CONCEPT EXPERIMENT

- NEXT LOGICAL STEP IN TECHNOLOGY DEVELOPMENT
- FOCUS ON TIMELY, ACCURATE, OBJECTIVE, FOREIGN CROP INVENTORY INFORMATION
- LARGE SCALE
- ONE IMPORTANT CROP
- FOCUS ON KEY COUNTRIES
- CONDUCT RIGOROUS ACCURACY ASSESSMENT
- MULTIAGENCY PARTICIPATION

NASA-S-78-16820



LACIE OBJECTIVES



- DEMONSTRATE AN IMPORTANT APPLICATION OF REPETITIVE MULTISPECTRAL REMOTE SENSING FROM SPACE

- TEST THE CAPABILITY OF LANDSAT, TOGETHER WITH CLIMATOLOGICAL, METEOROLOGICAL, AND CONVENTIONAL DATA SOURCES, TO ESTIMATE THE PRODUCTION OF AN IMPORTANT WORLD CROP

- VALIDATE TECHNOLOGY TO PROVIDE USEFUL ESTIMATES OF CROP PRODUCTION

NASA-S-78-16091

LARGE AREA CROP INVENTORY EXPERIMENT



NASA NOAA USDA

NASA





INDUSTRY AND UNIVERSITIES

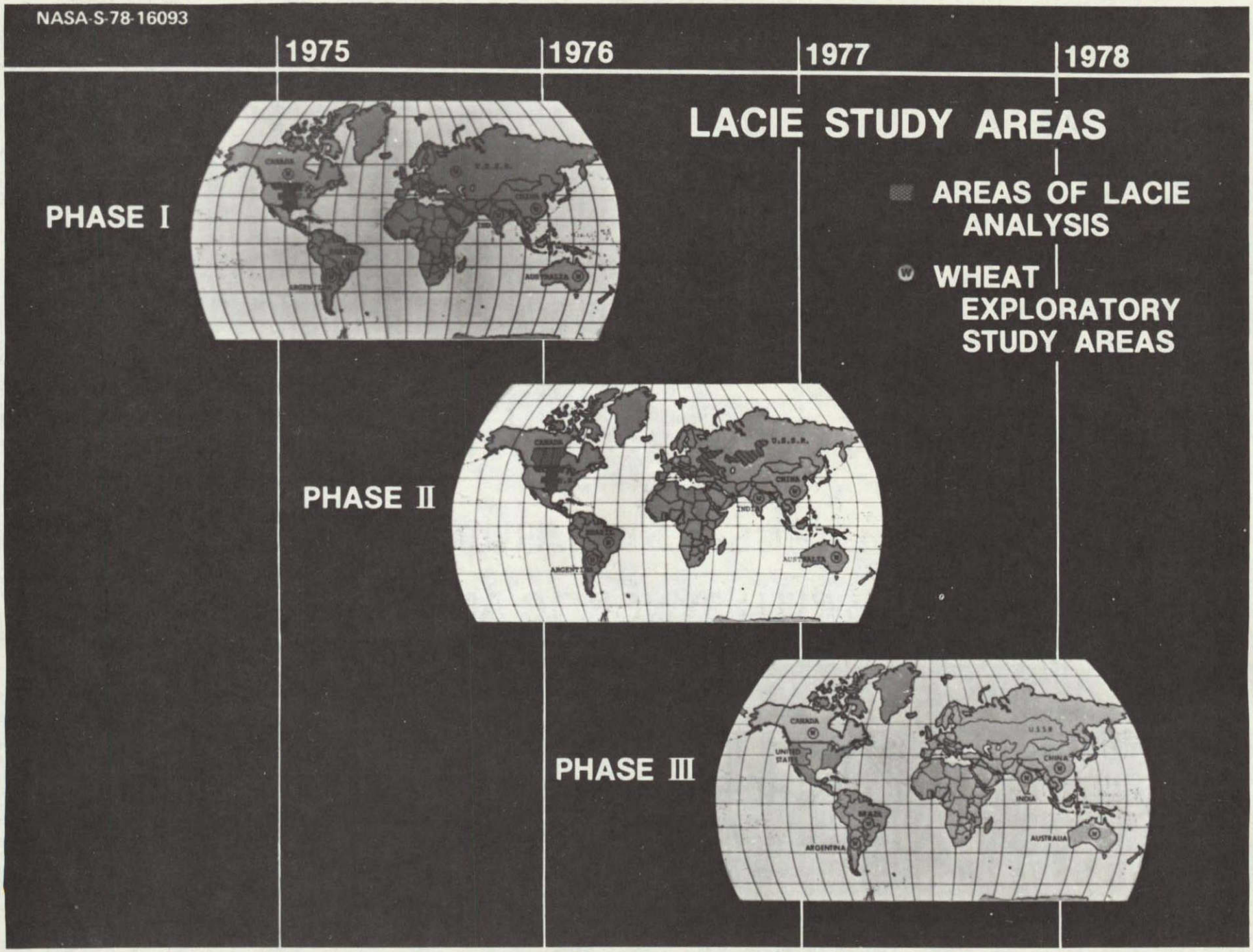
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NASA-S-78-16096

WHY WHEAT?

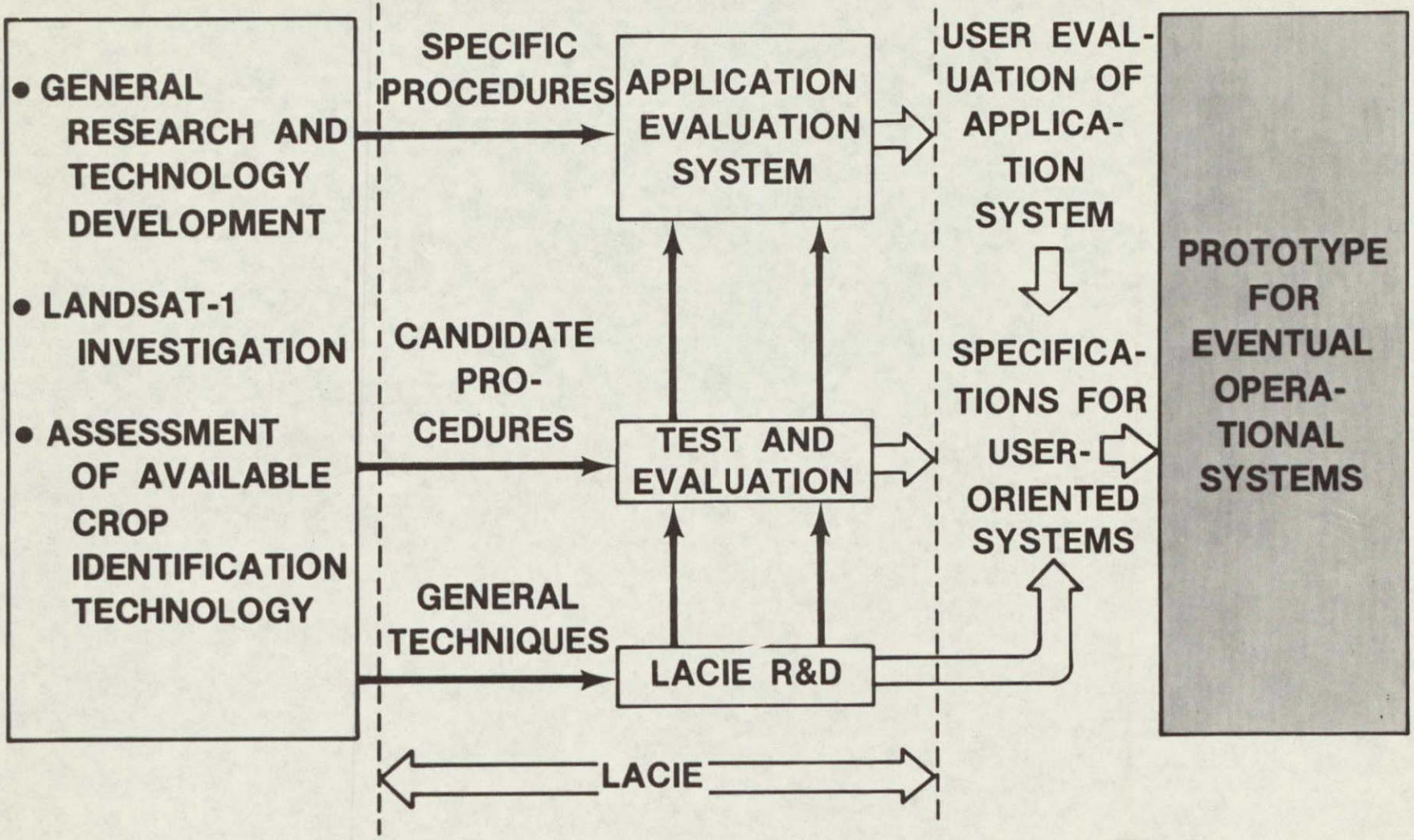
- MAJOR CROP IN THE WORLD MARKET
- GROWN OVER LARGE GEOGRAPHIC AREAS
  - COMPATIBLE WITH SYNOPTIC AND RAPID RESPONSE CAPABILITIES OF SATELLITE REMOTE SENSING
- CONSIDERED TO BE THE LEAST COMPLEX AND BEST UNDERSTOOD CROP IN TERMS OF REMOTE SENSING

NASA-S-78-16093



NASA-S-78-16094

LACIE PROJECT ELEMENTS

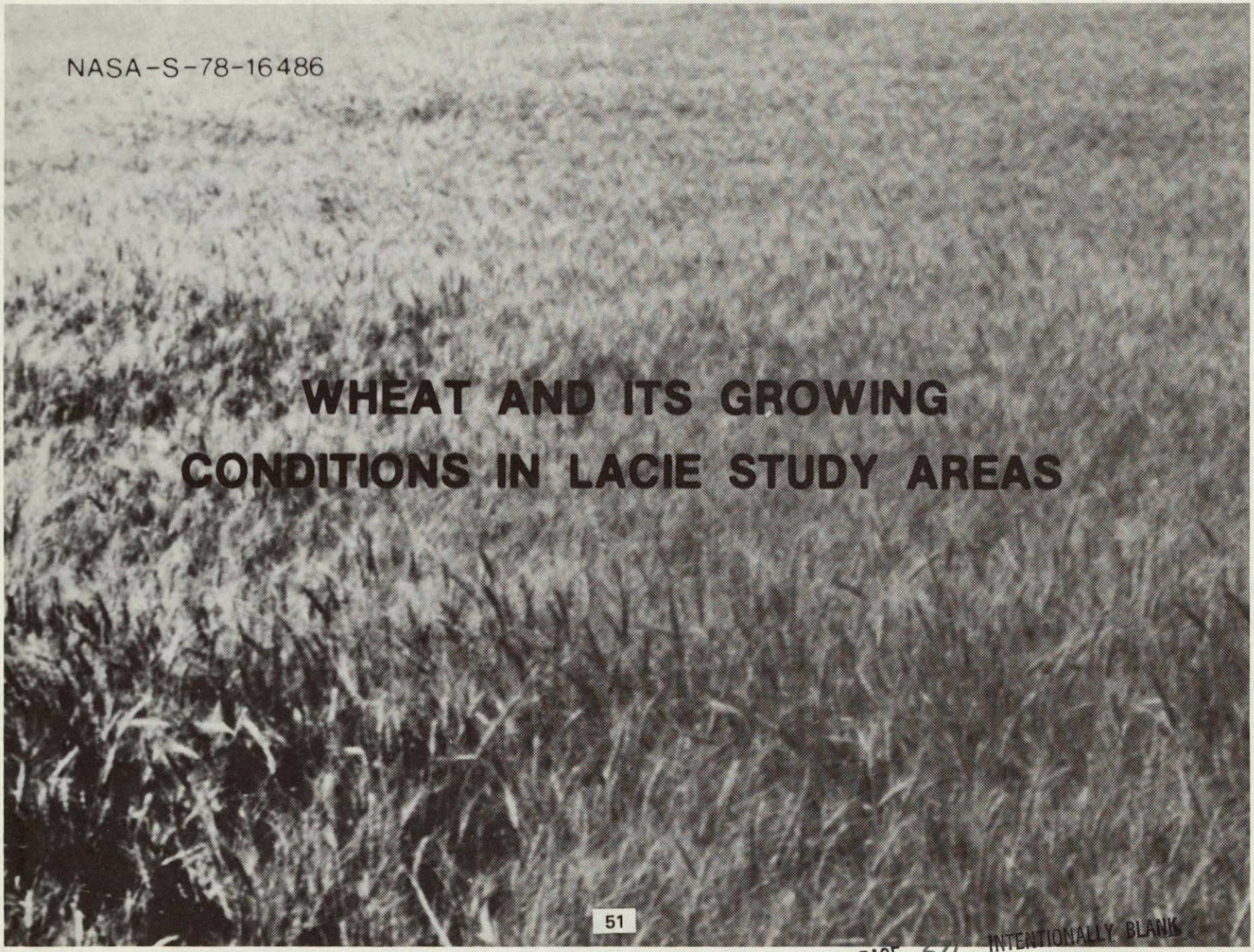


PLENARY PRESENTATION NO. 4

WHEAT AND ITS GROWING CONDITIONS IN LACIE STUDY AREAS

D. Thompson, JSC

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NASA National Aeronautics and Space Administration

Lyndon B. Johnson Space Center
Houston, Texas 77058

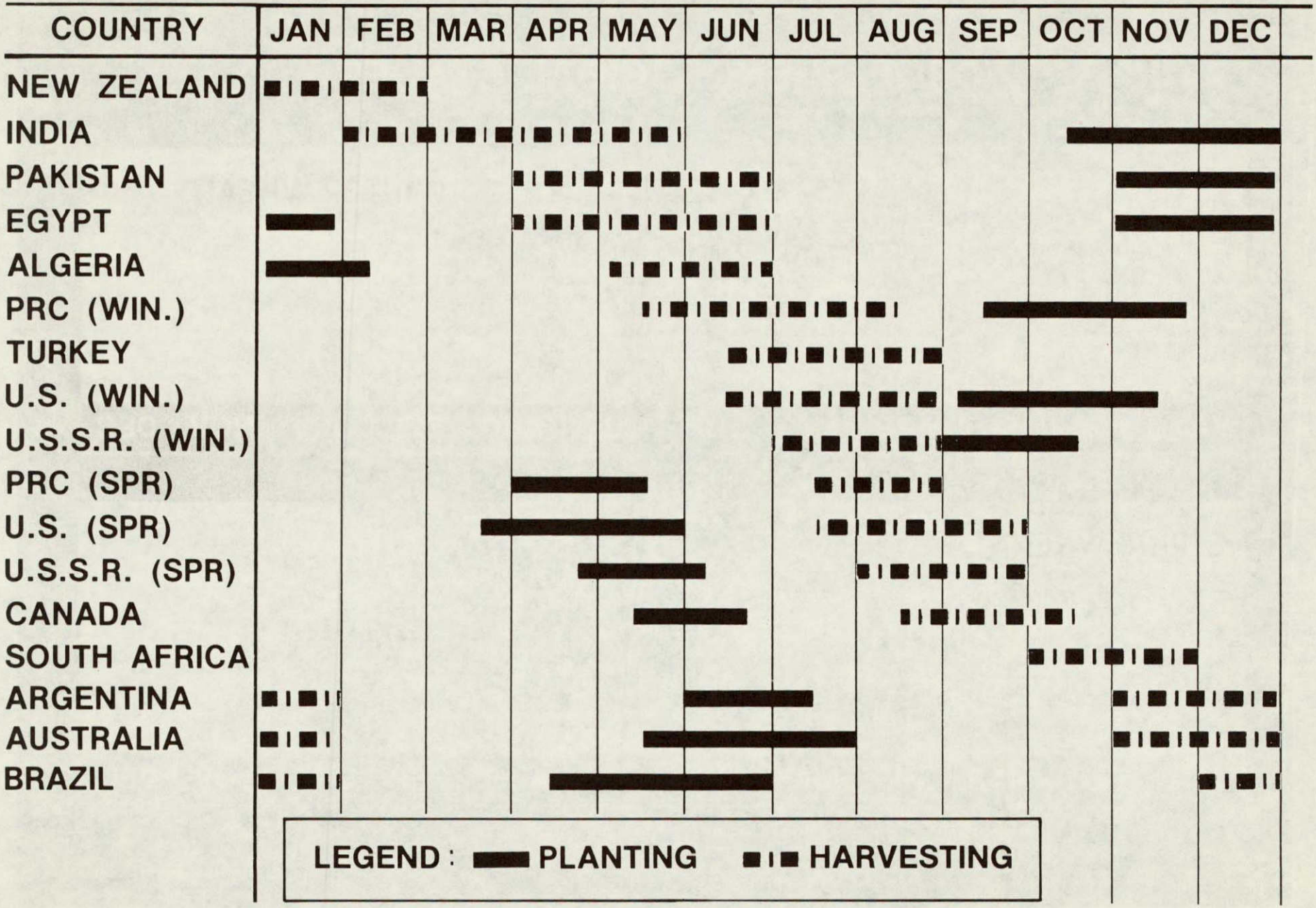
NASA-S-78-16460

TYPES OF WHEAT, THEIR MARKET CLASSES AND CLIMATIC CONDITIONS

GROWTH HABIT	MAJOR MARKET CLASSES (U.S.)	GENERAL CLIMATIC CONDITIONS
WINTER	HARD RED WINTER	SEMIARID – COLD WINTERS
	SOFT RED WINTER	HUMID – MILD TO COLD WINTERS
	WHITE	ARID TO SEMIARID – MILD WINTERS
SPRING (SPRING PLANTED)	HARD RED SPRING	SEMIARID – VERY COLD WINTERS
	DURUM	SEMIARID – VERY COLD WINTERS
SPRING (WINTER PLANTING)	DURUM	ARID (OFTEN IRRIGATED) – MILD WINTERS
	WHITE	ARID TO HUMID – MILD WINTERS
	SOFT RED	ARID TO HUMID – MILD WINTERS

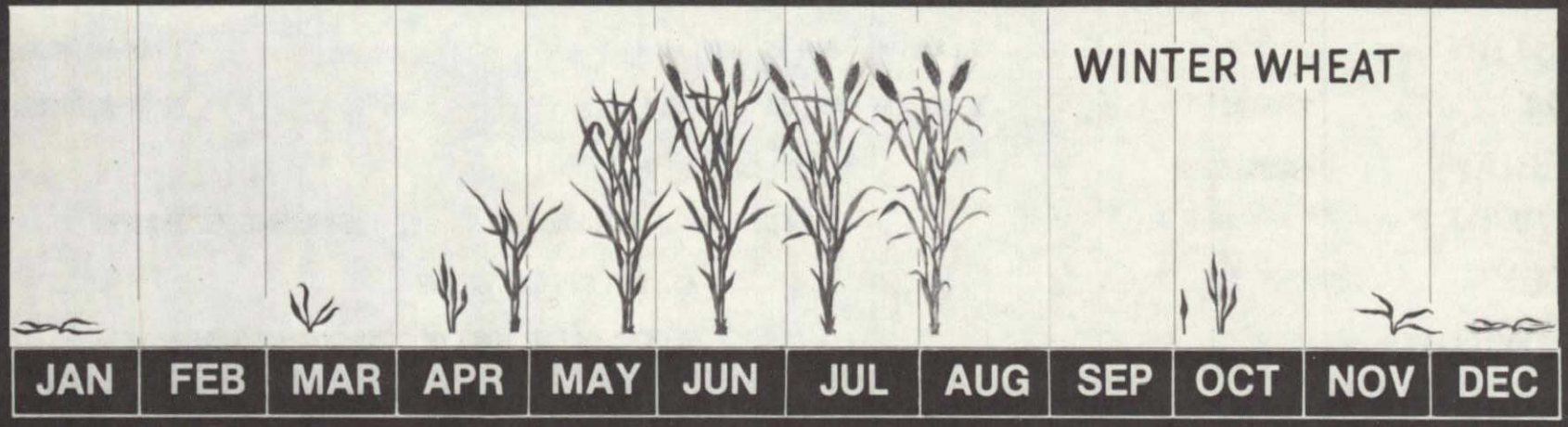
NASA-S-78-16469

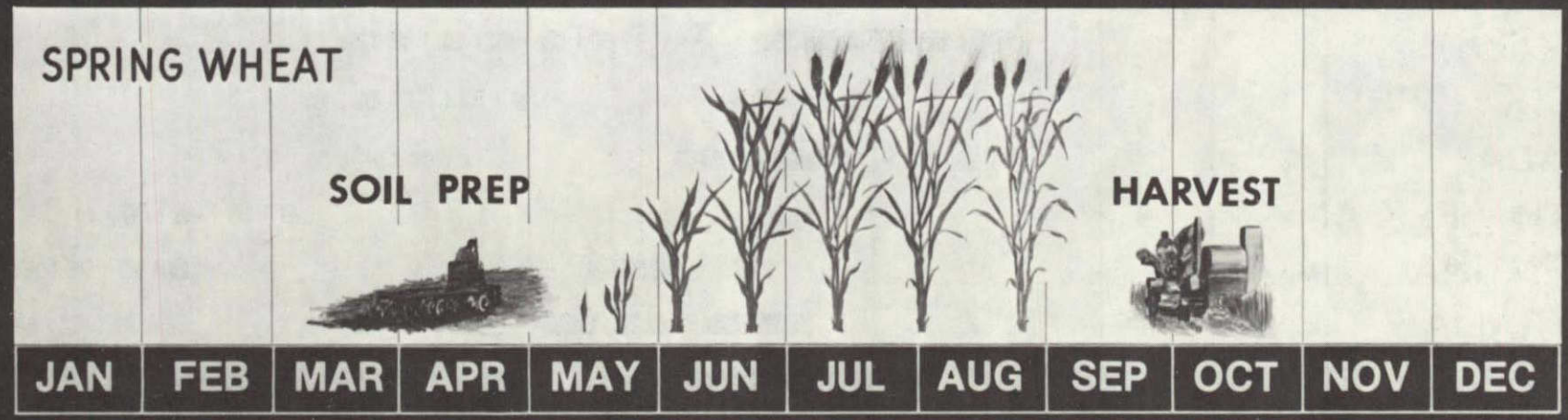
WHEAT GROWING SEASON FOR SELECTED COUNTRIES



NASA-S-78-16801

CROP PHENOLOGICAL STAGES

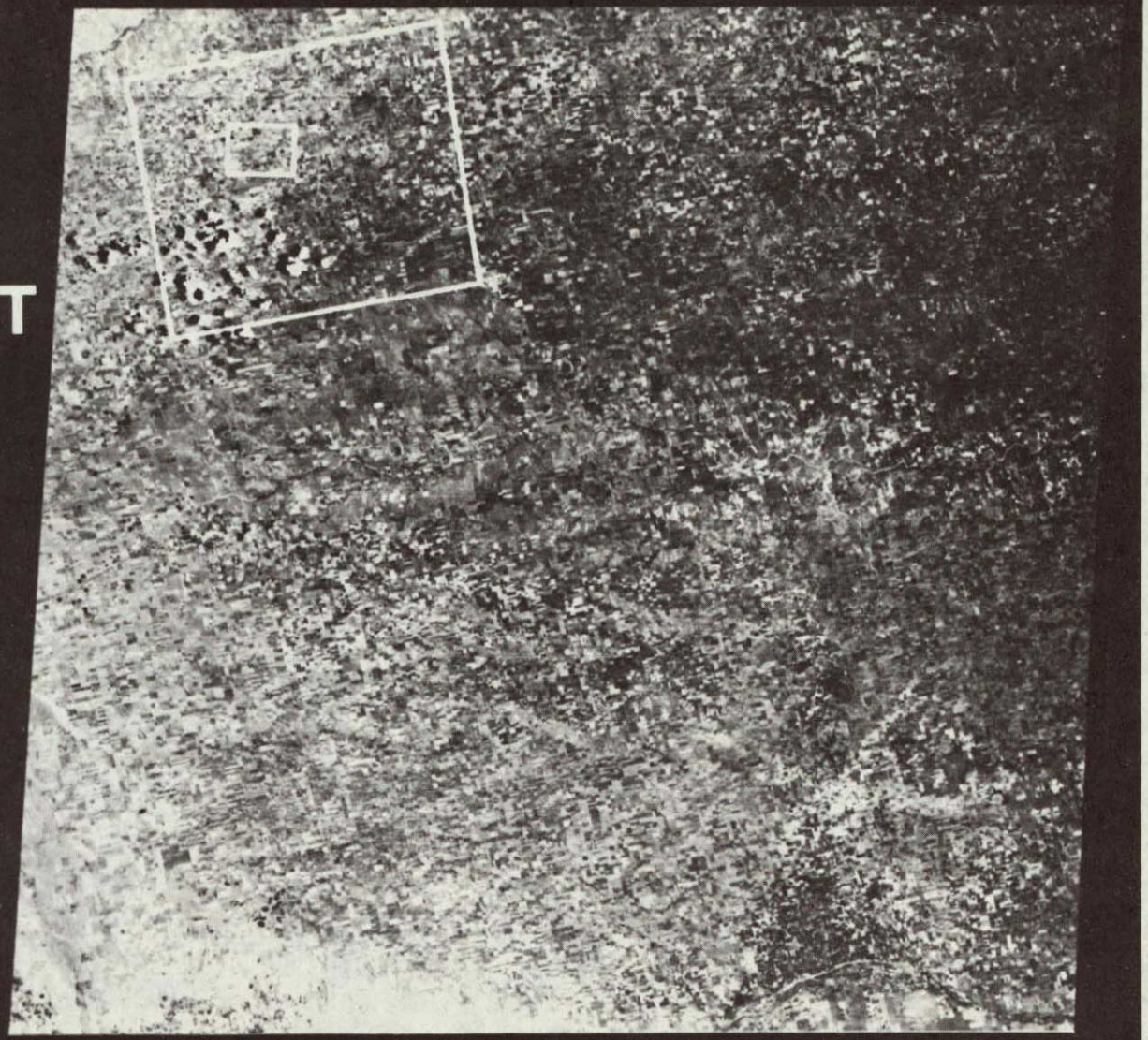




NASA-S-78-16490

U.S. WINTER WHEAT

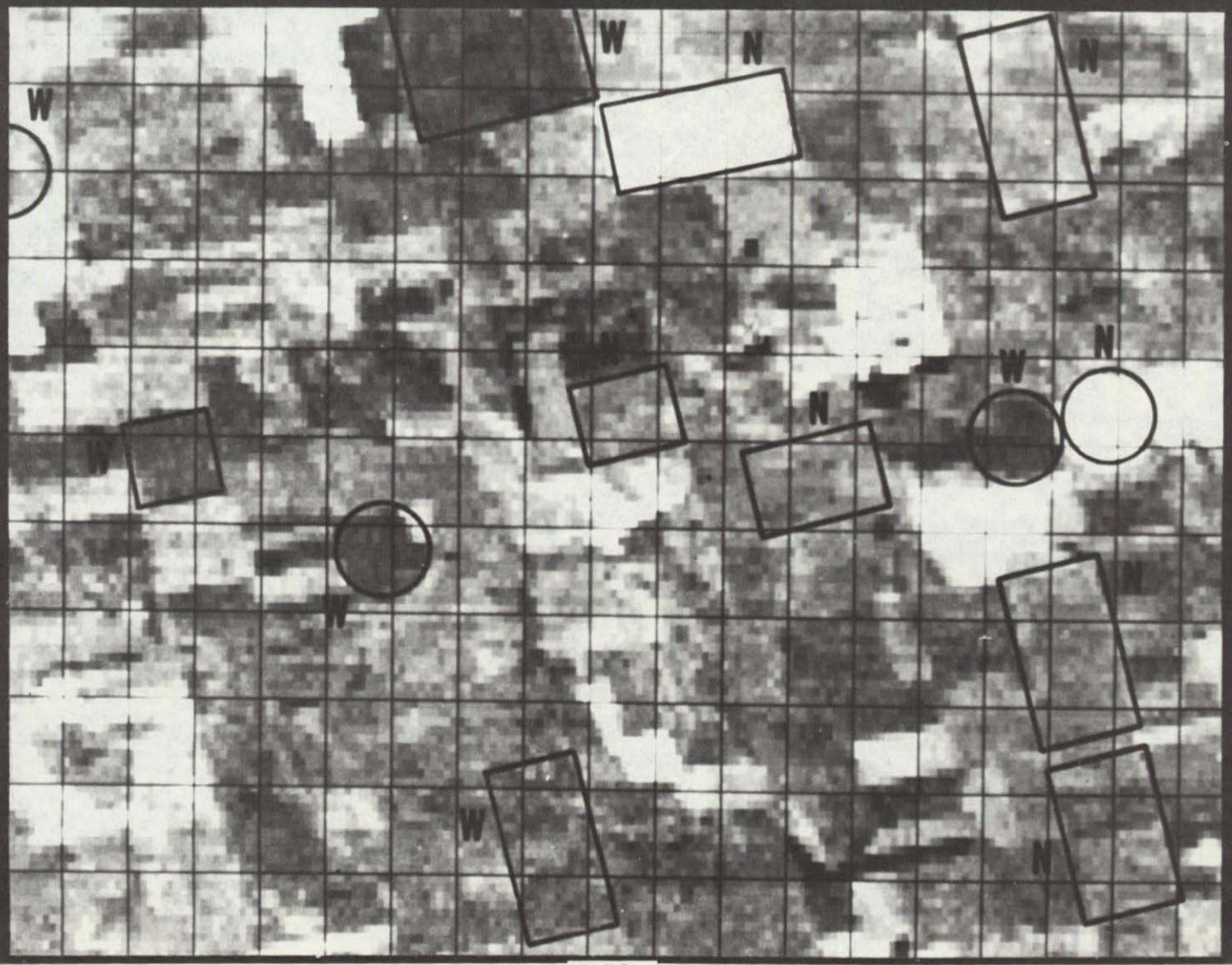
FULL LANDSAT FRAME, JUNE 12, 1976 LACIE SEGMENT 1021, SHERMAN, KANSAS



NASA-S-78-16484

EMERGENT STAGE

LACIE SEGMENT 1021, NOVEMBER 10, 1975
LANDSAT IMAGE, SHERMAN, KANSAS

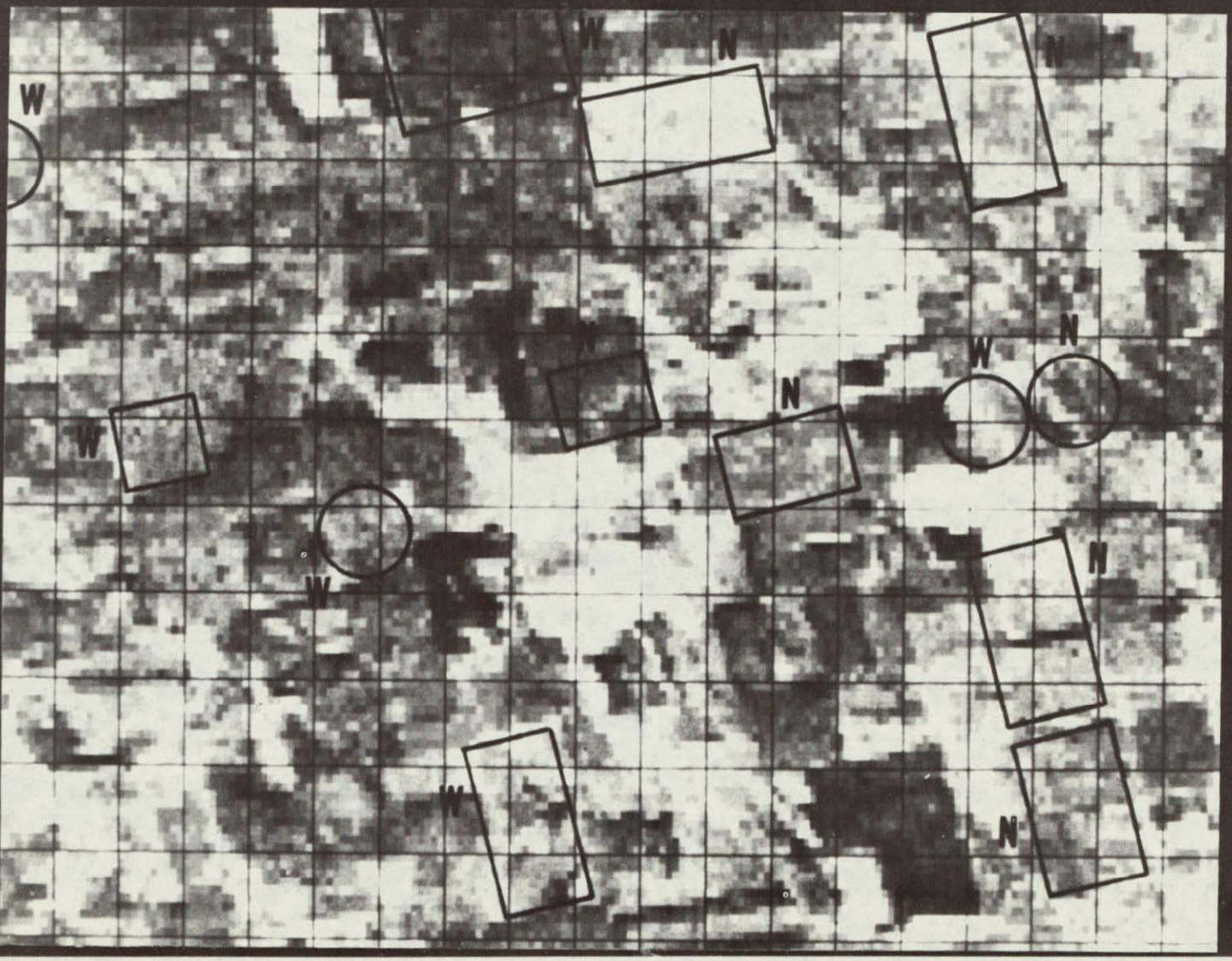


NASA-S-78-16478

REGROWTH STAGE

LACIE SEGMENT 1021, FEBRUARY 25, 1976

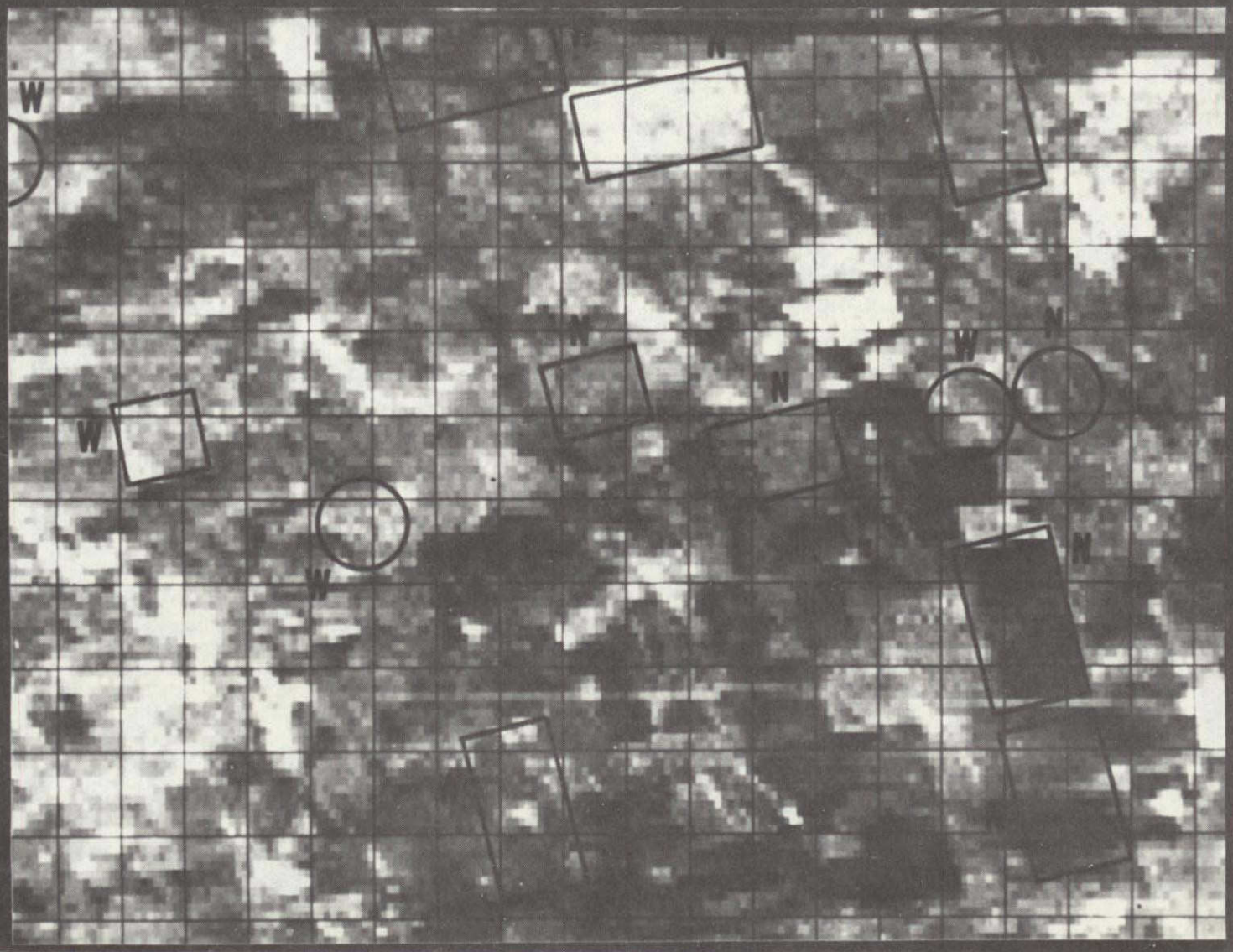
LANDSAT IMAGE, SHERMAN, KANSAS



NASA-S-78-16481

PRE-JOINTING STAGE

LACIE SEGMENT 1021, MARCH 14, 1976
LANDSAT IMAGE, SHERMAN, KANSAS

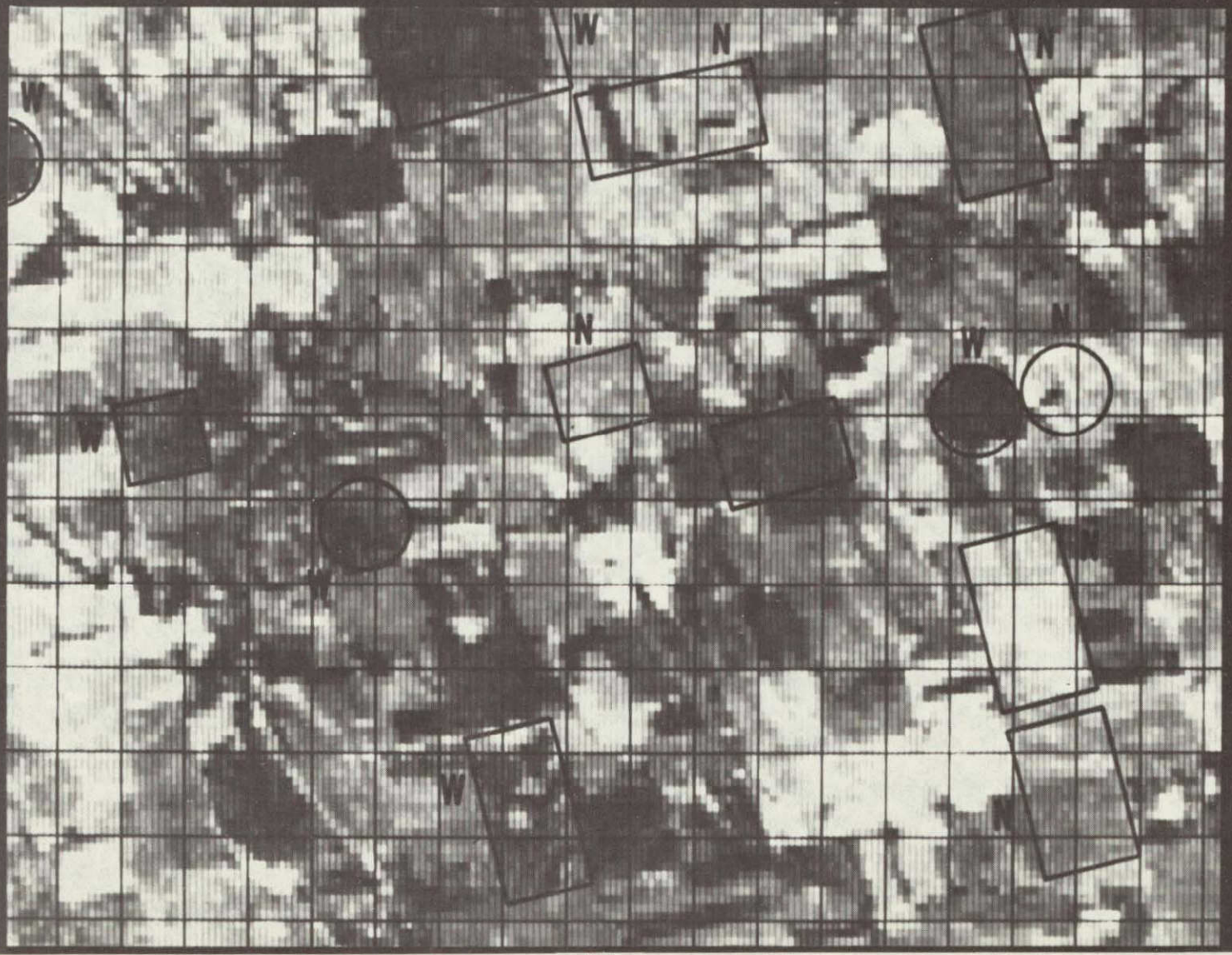


NASA-S-78-16485

HEADING STAGE

LACIE SEGMENT 1021, JUNE 12, 1976

LANDSAT IMAGE, SHERMAN, KANSAS

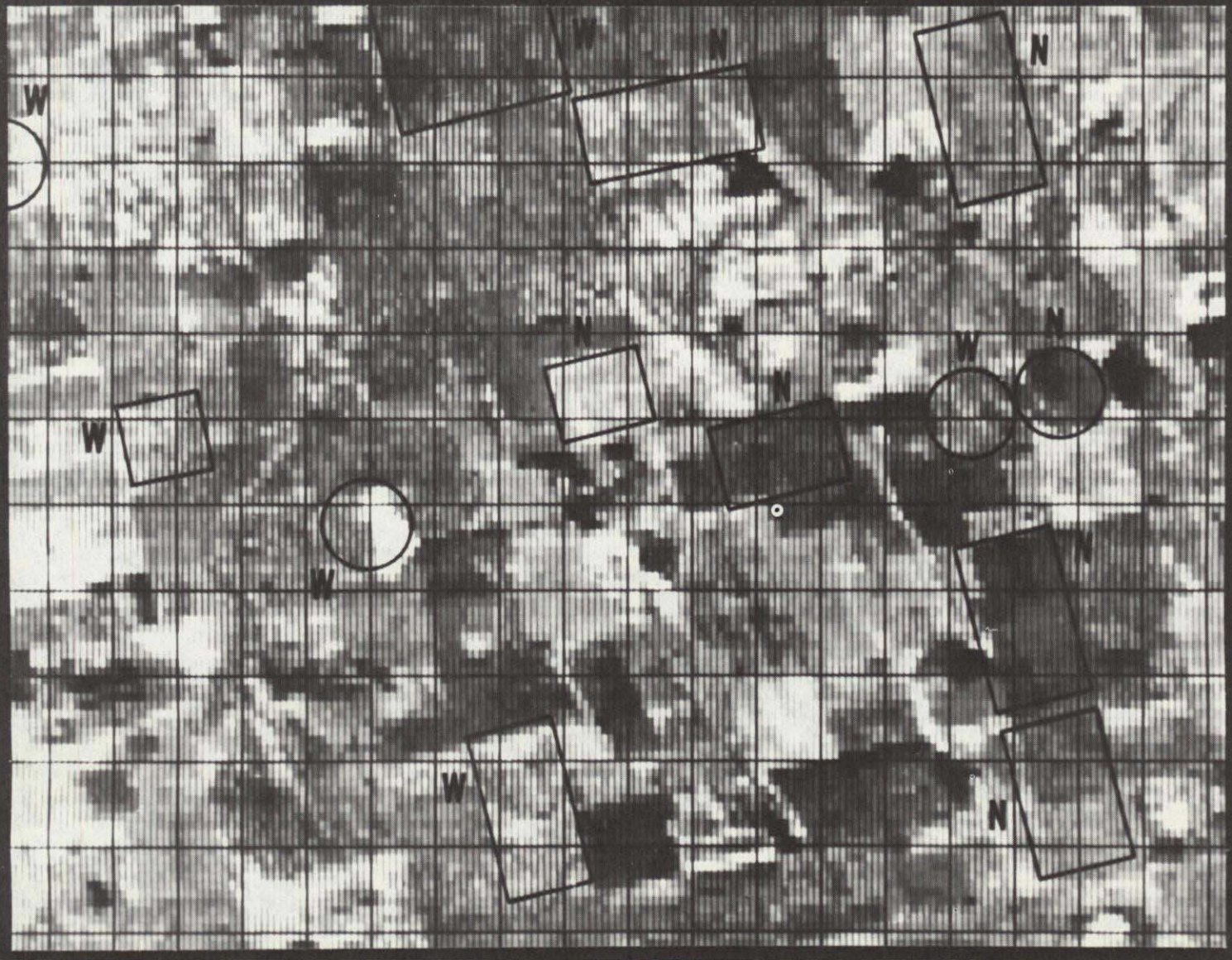


NASA-S-78-16467

SOFT DOUGH STAGE

LACIE SEGMENT 1021, JULY 1, 1976

LANDSAT IMAGE, SHERMAN, KANSAS

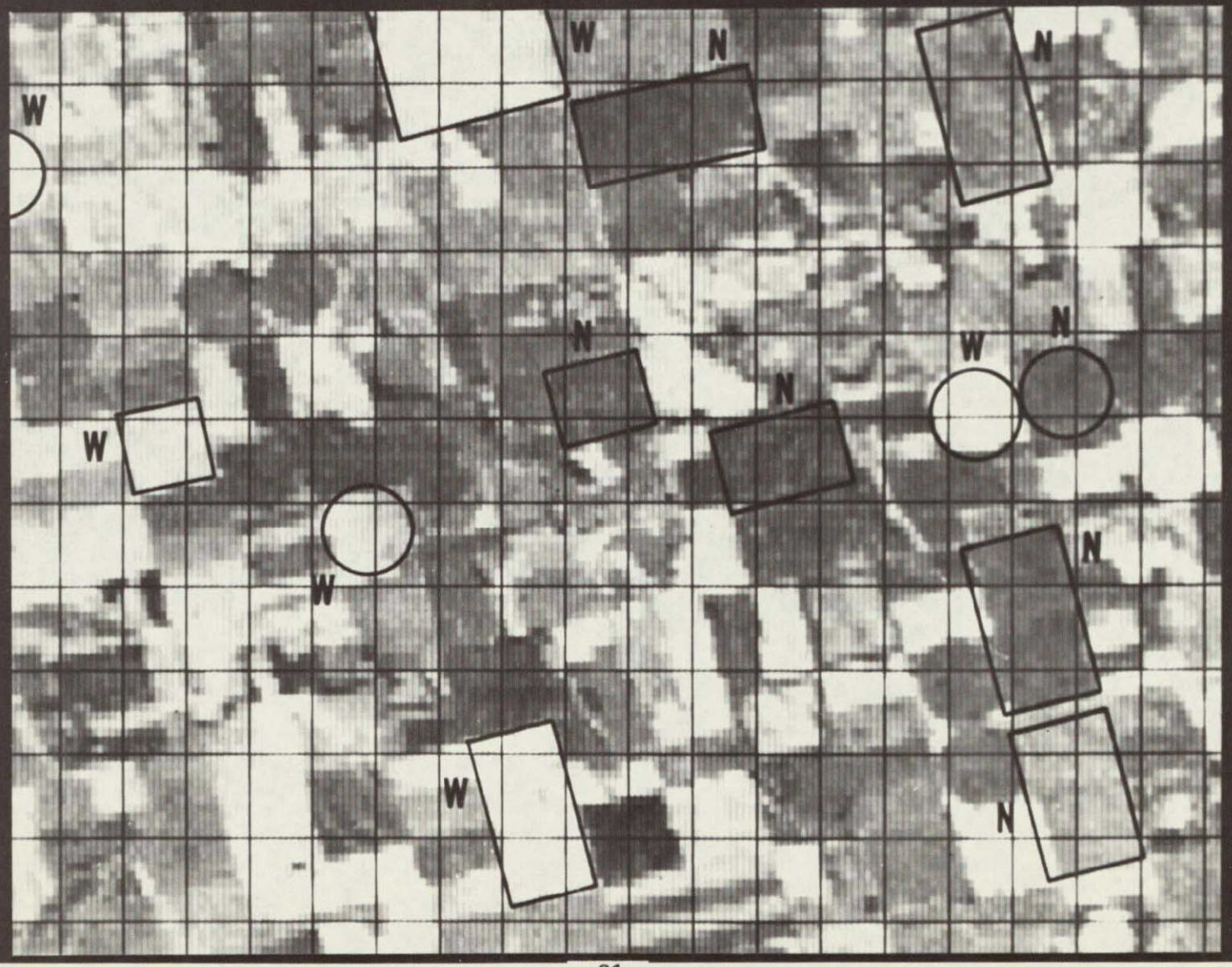


NASA-S-78-16477

RIPE-HARVEST STAGE

LACIE SEGMENT 1021, JULY 19, 1976

LANDSAT IMAGE, SHERMAN, KANSAS



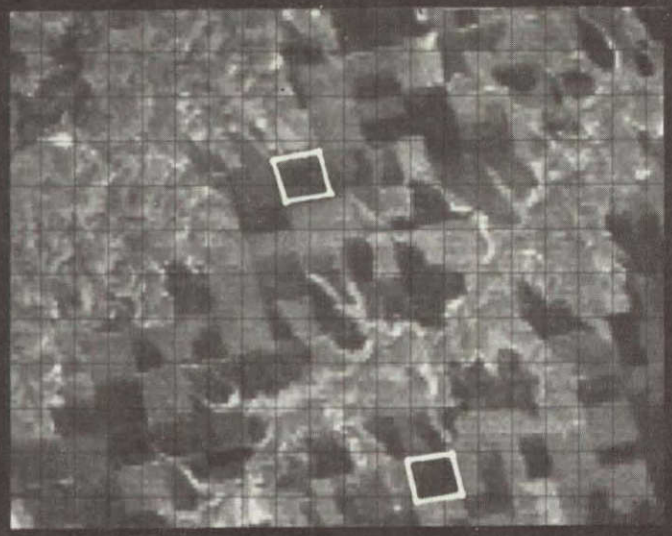
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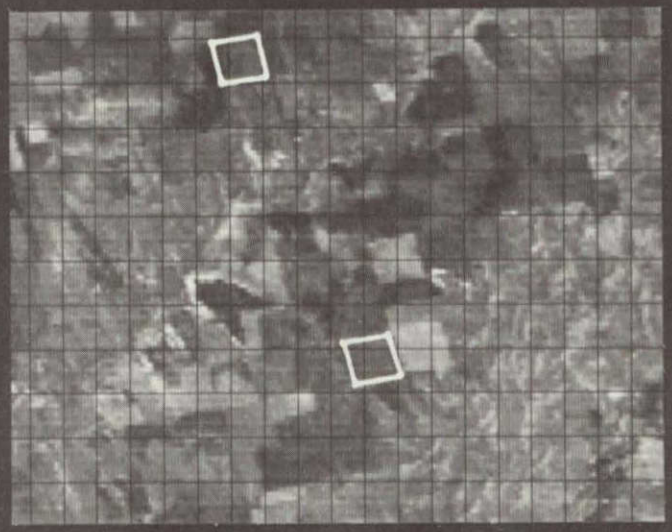
MANAGEMENT PRACTICES

NASA-S-78-16466

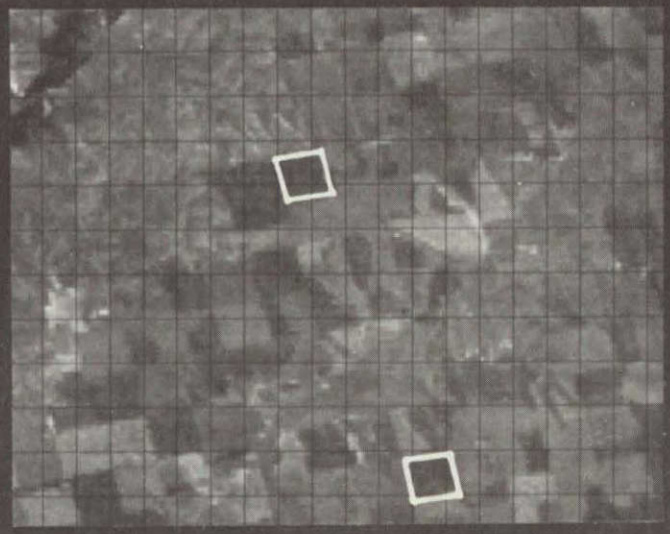
CROPPING PRACTICES



APR 1, 1976
WHEAT



APR 14, 1977
FALLOW

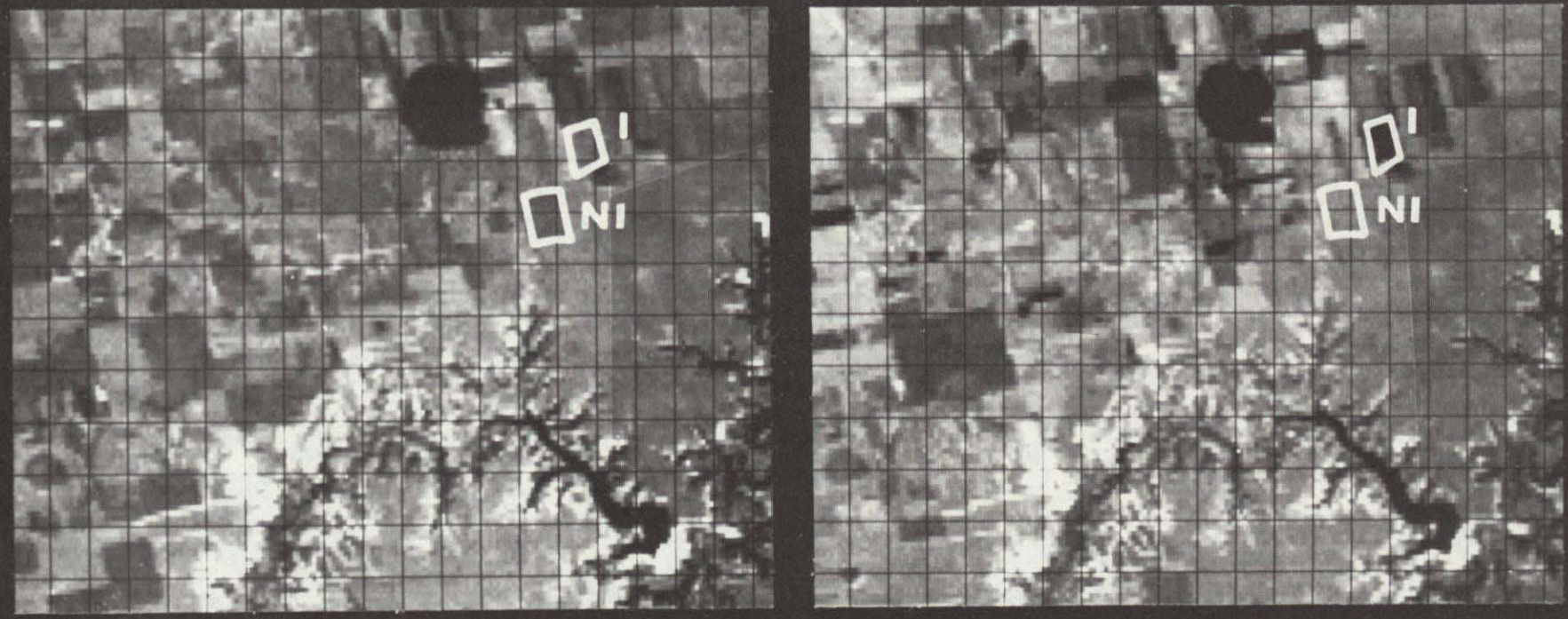


APR 27, 1978
WHEAT

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NASA-S-78-16474

DRYLAND VS IRRIGATED WHEAT



MAR 21, 1978

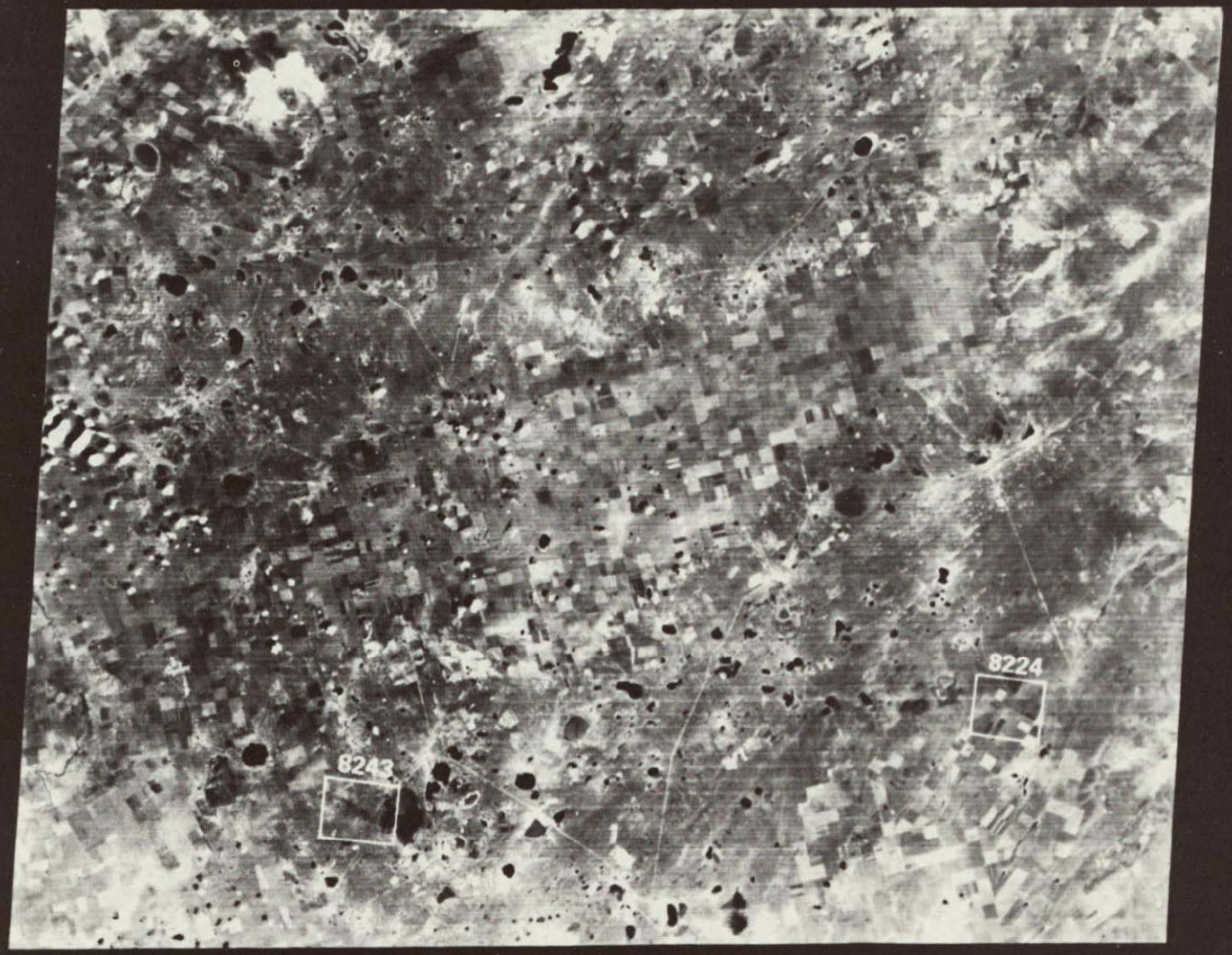
APR 26, 1978

I = IRRIGATED

NI = NONIRRIGATED

NASA-S-78-16445

LAND USE CHANGES - U.S.S.R.



MAY 29, 1973

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NASA-S-78-16449

LAND USE CHANGES - U.S.S.R.



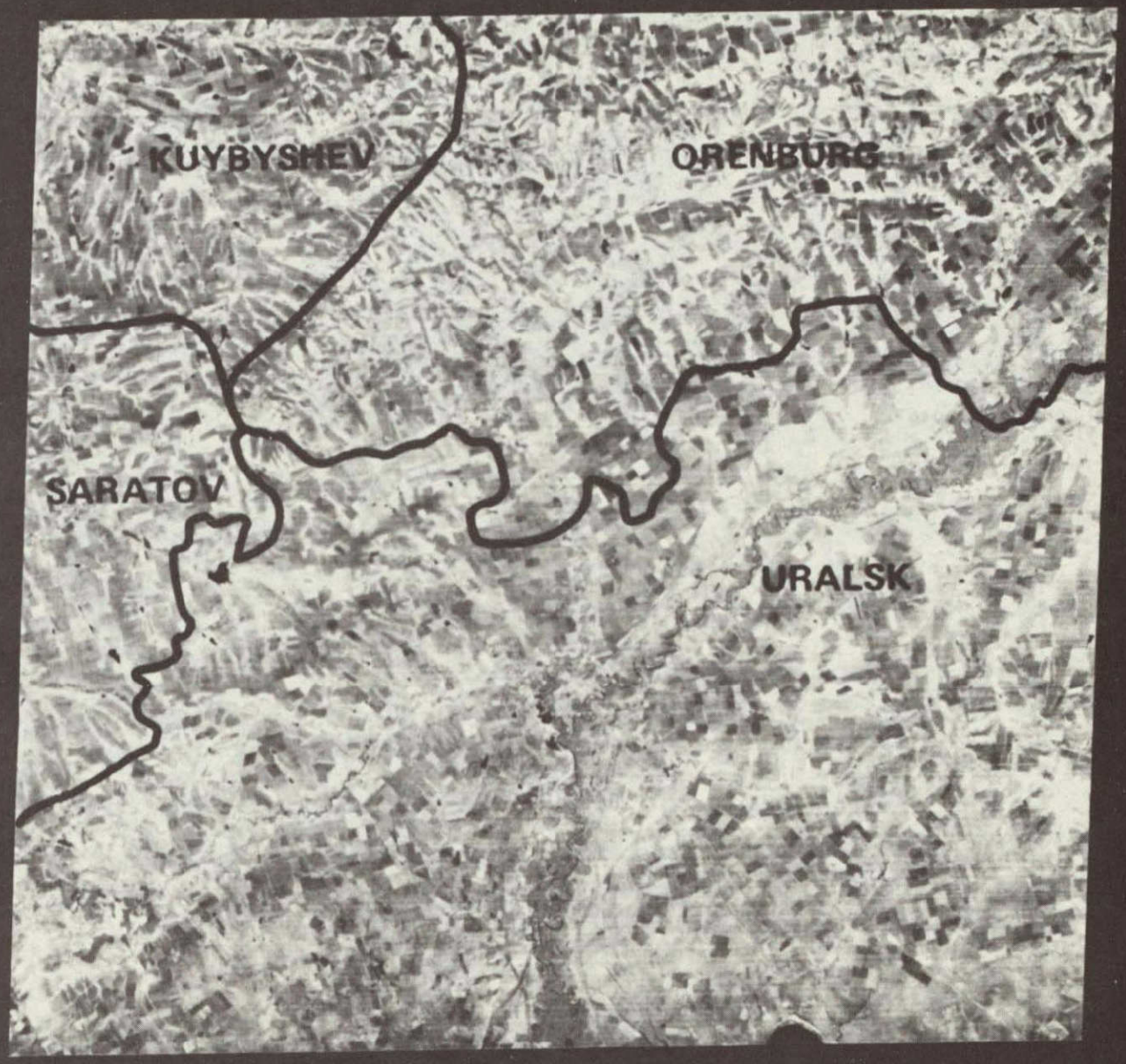
MAY 10, 1975

NASA-S-78-16444

SARATOV, U.S.S.R. 1974-75

DROUGHT CONDITIONS

JUNE 23, 1975



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NASA-S-78-16465

SARATOV, U.S.S.R. 1975-76

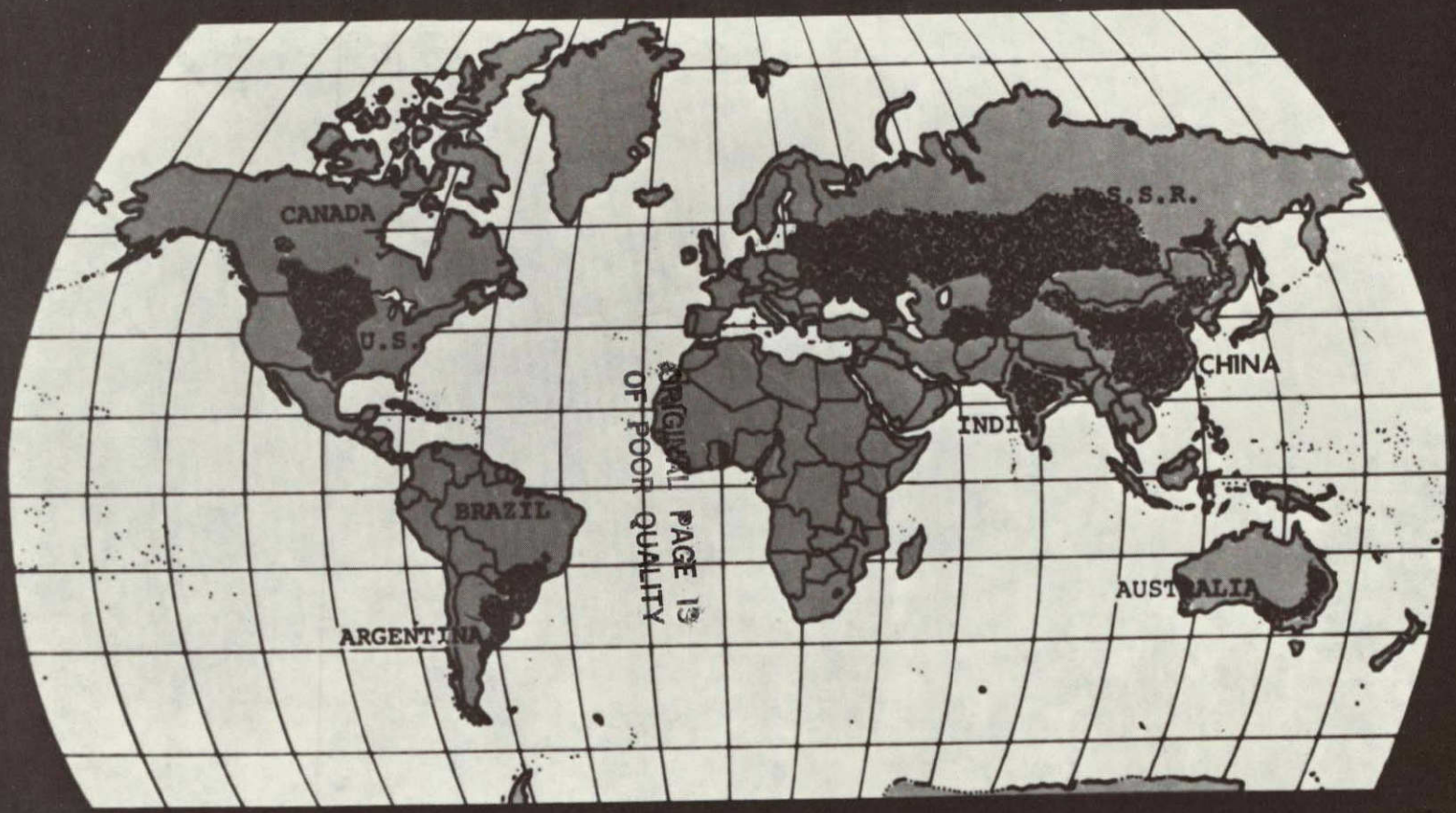
NORMAL MOISTURE CONDITIONS



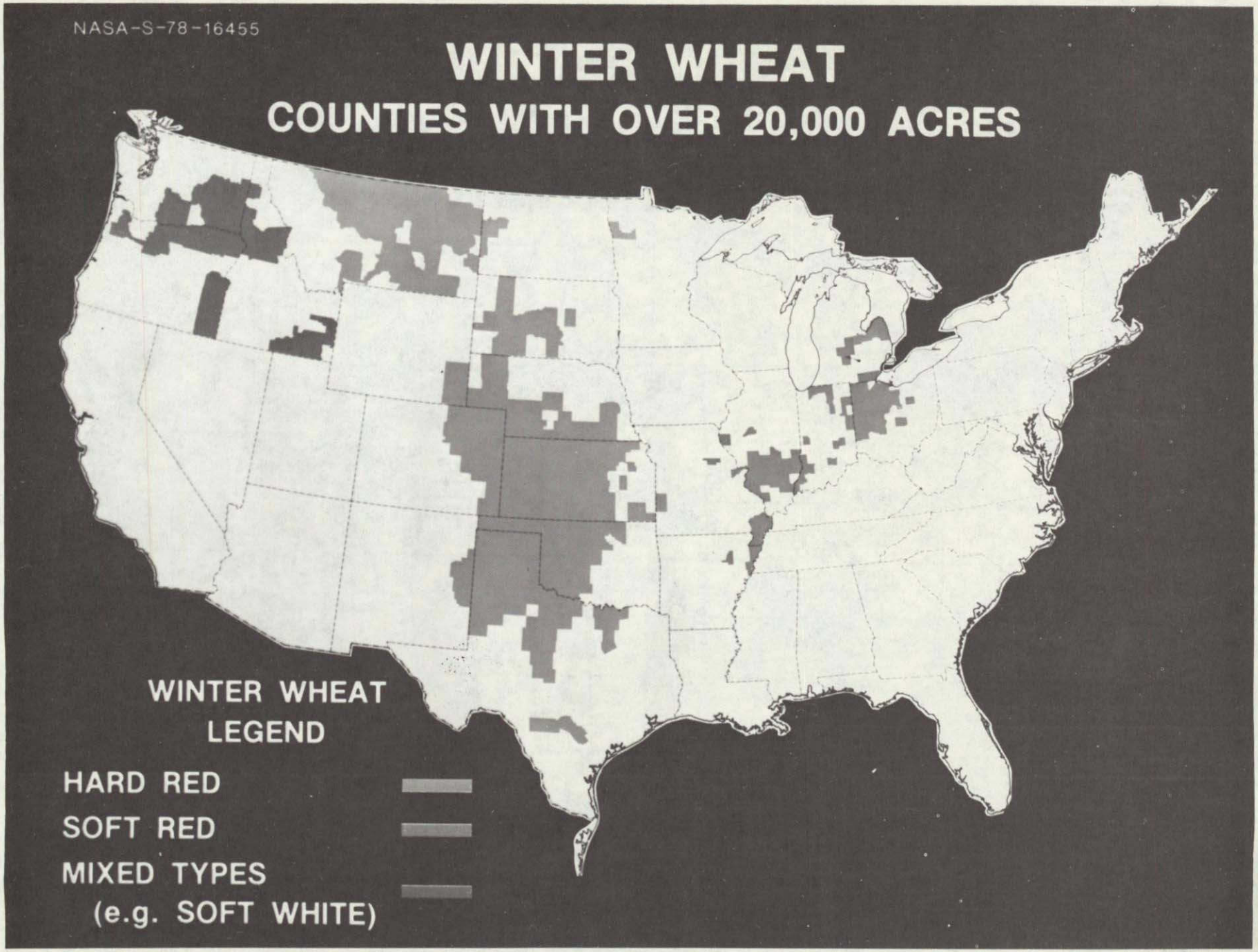
JUNE 17, 1976

NASA-S-78-16800

MAJOR WHEAT-PRODUCING REGIONS CONSIDERED IN LACIE



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NASA-S-78-16455
WINTER WHEAT
COUNTIES WITH OVER 20,000 ACRES
WINTER WHEAT
LEGEND
HARD RED
SOFT RED
MIXED TYPES
(e.g. SOFT WHITE)

NASA-S-78-16471

U.S. WINTER WHEAT

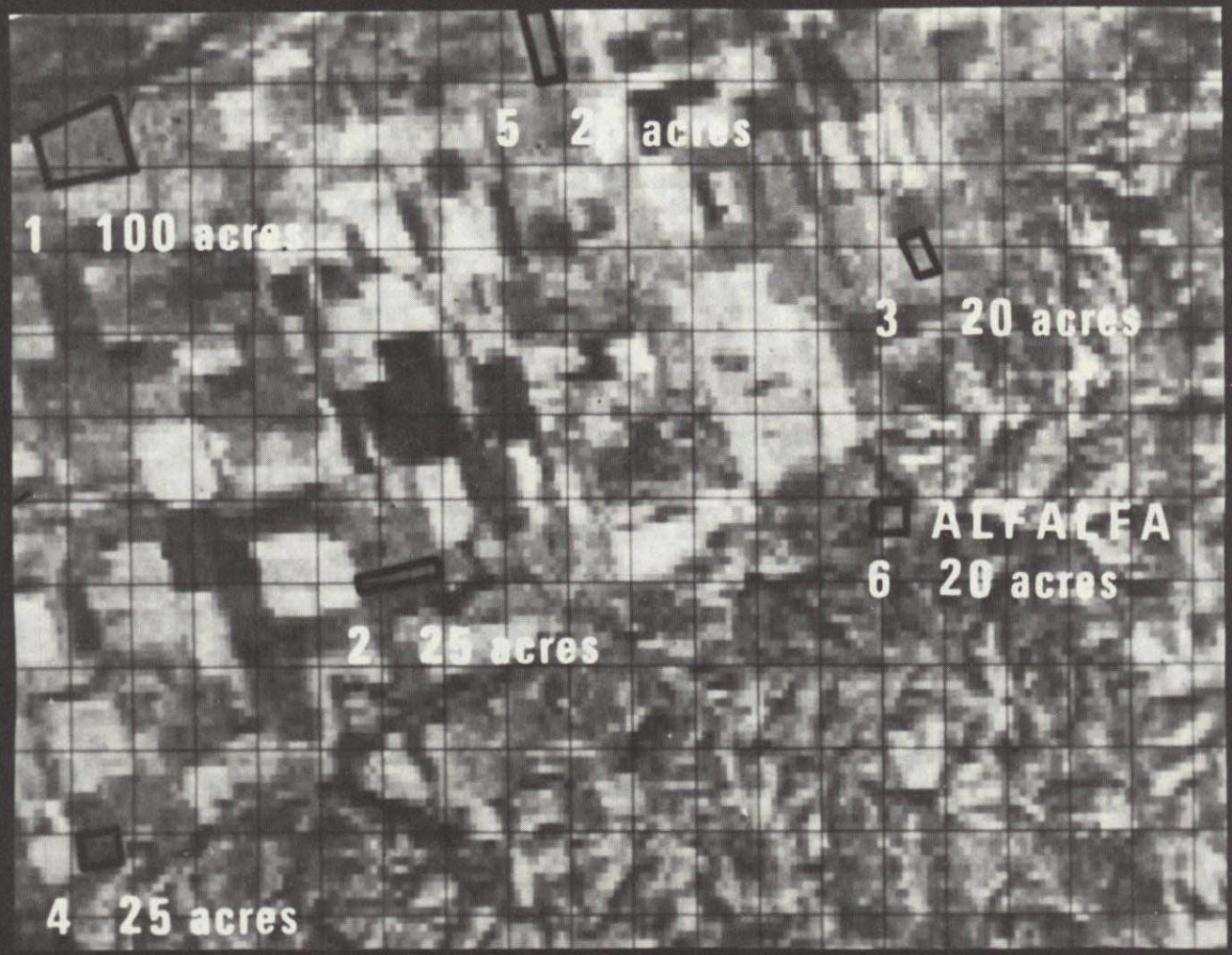
MAY 14, 1978



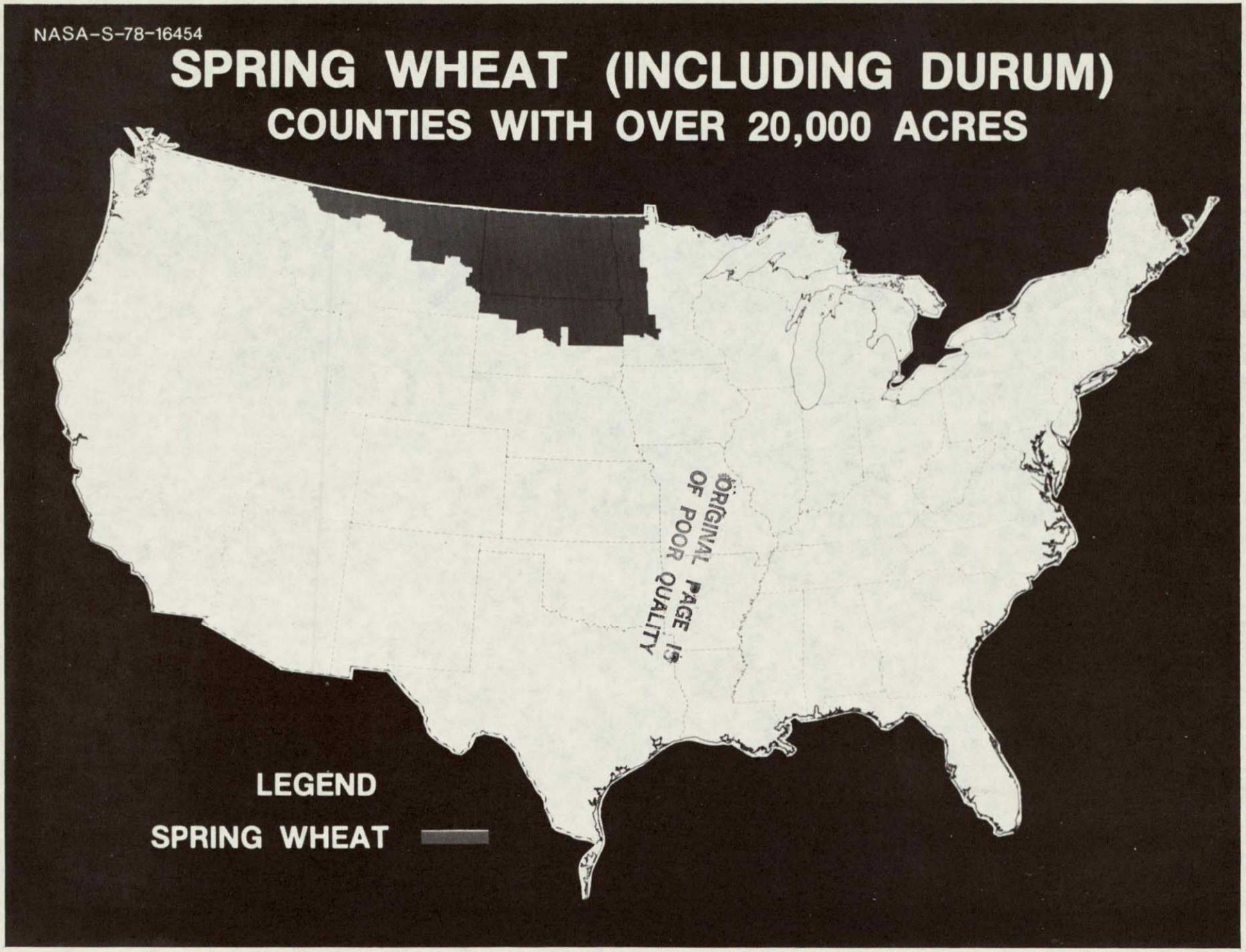
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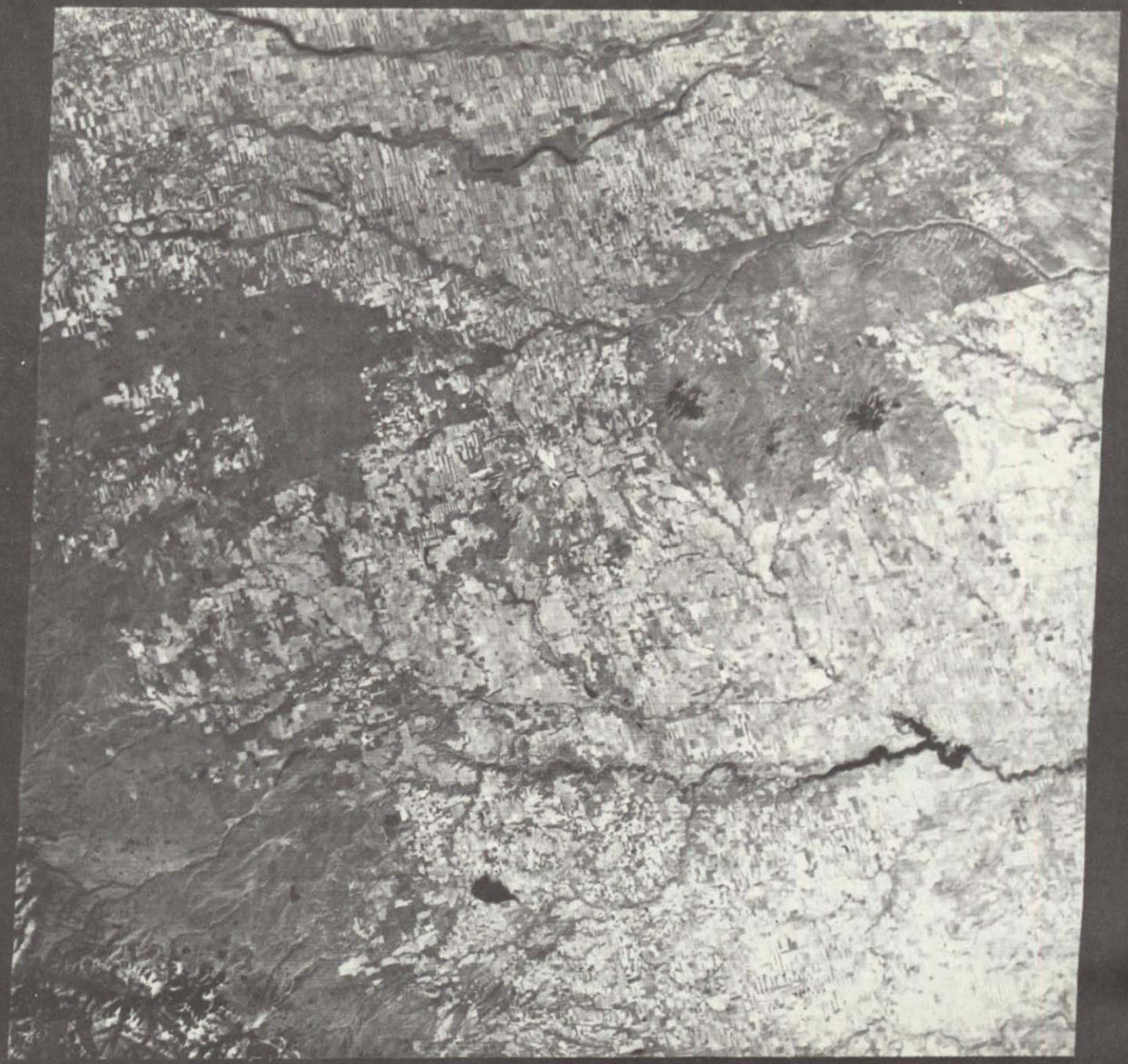
U.S. WINTER WHEAT



NOV 7, 1975


NASA-S-78-16454
SPRING WHEAT (INCLUDING DURUM)
COUNTIES WITH OVER 20,000 ACRES
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LEGEND
SPRING WHEAT

NASA-S-78-16458



U.S. SPRING WHEAT

SEPT 20, 1976

NASA-S-78-16479

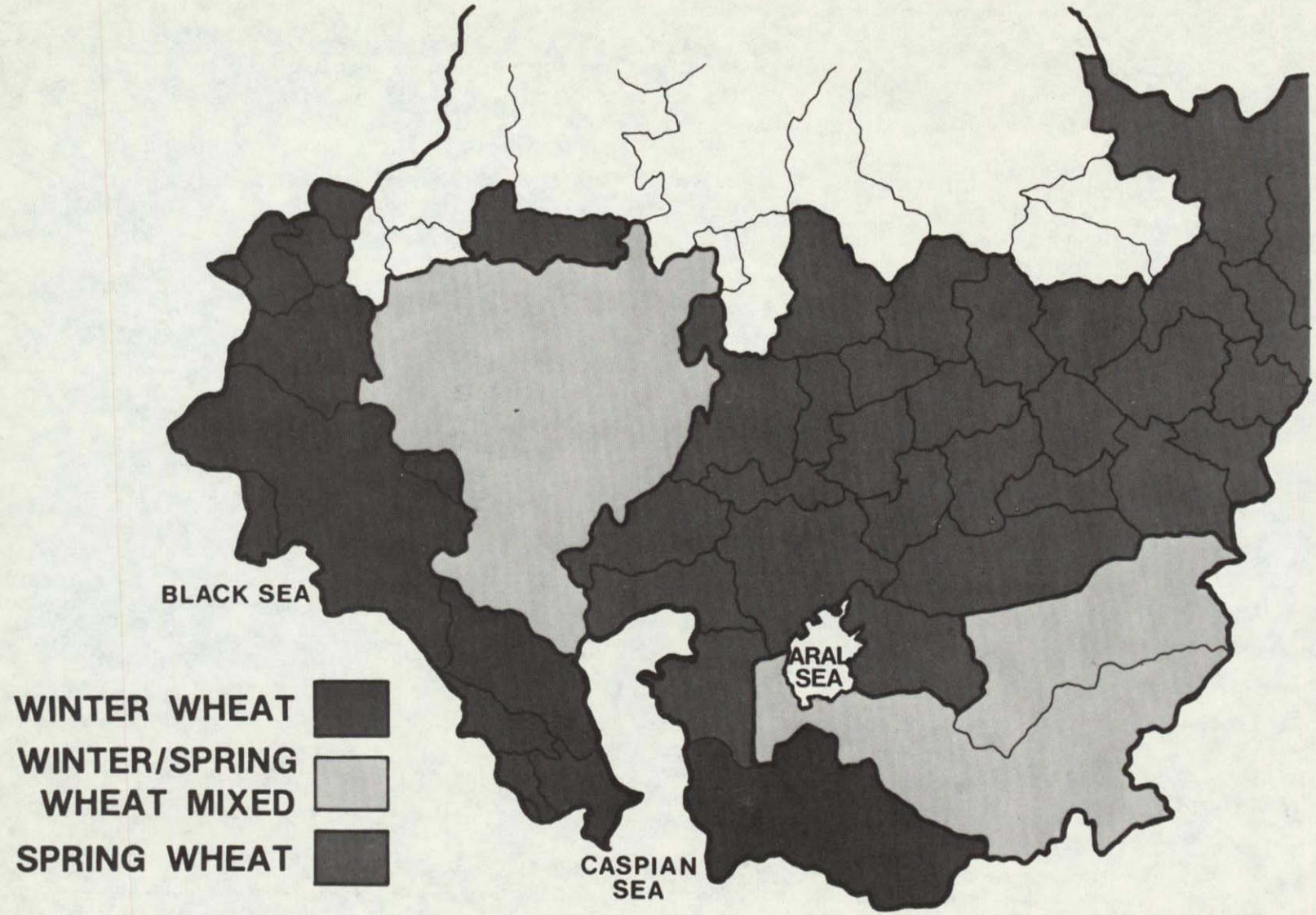
U.S. SPRING WHEAT



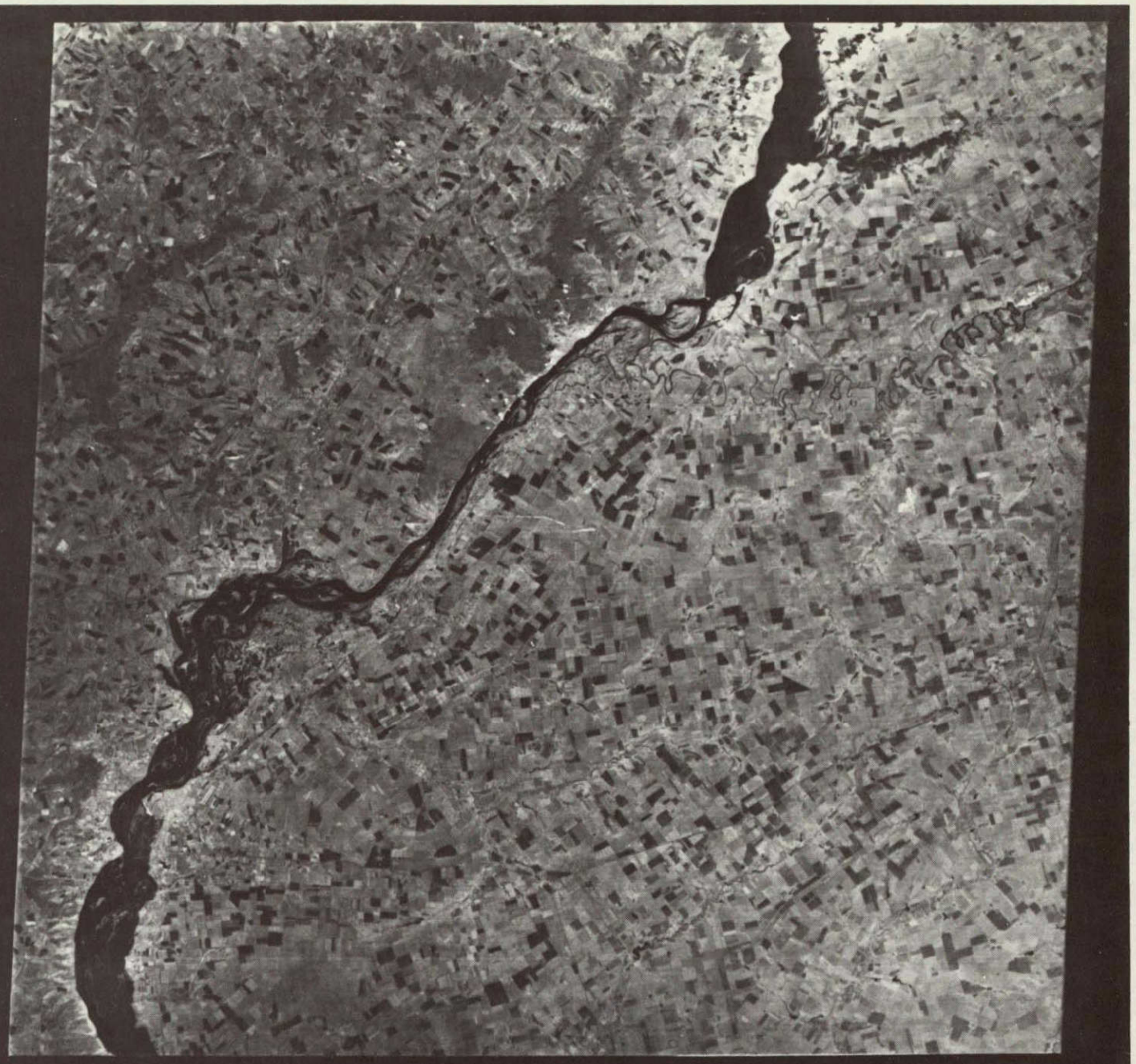
AUG 18, 1977

NASA-S-78-16440

MAJOR WHEAT PRODUCING REGIONS OF U.S.S.R.



NASA-S-78-16435



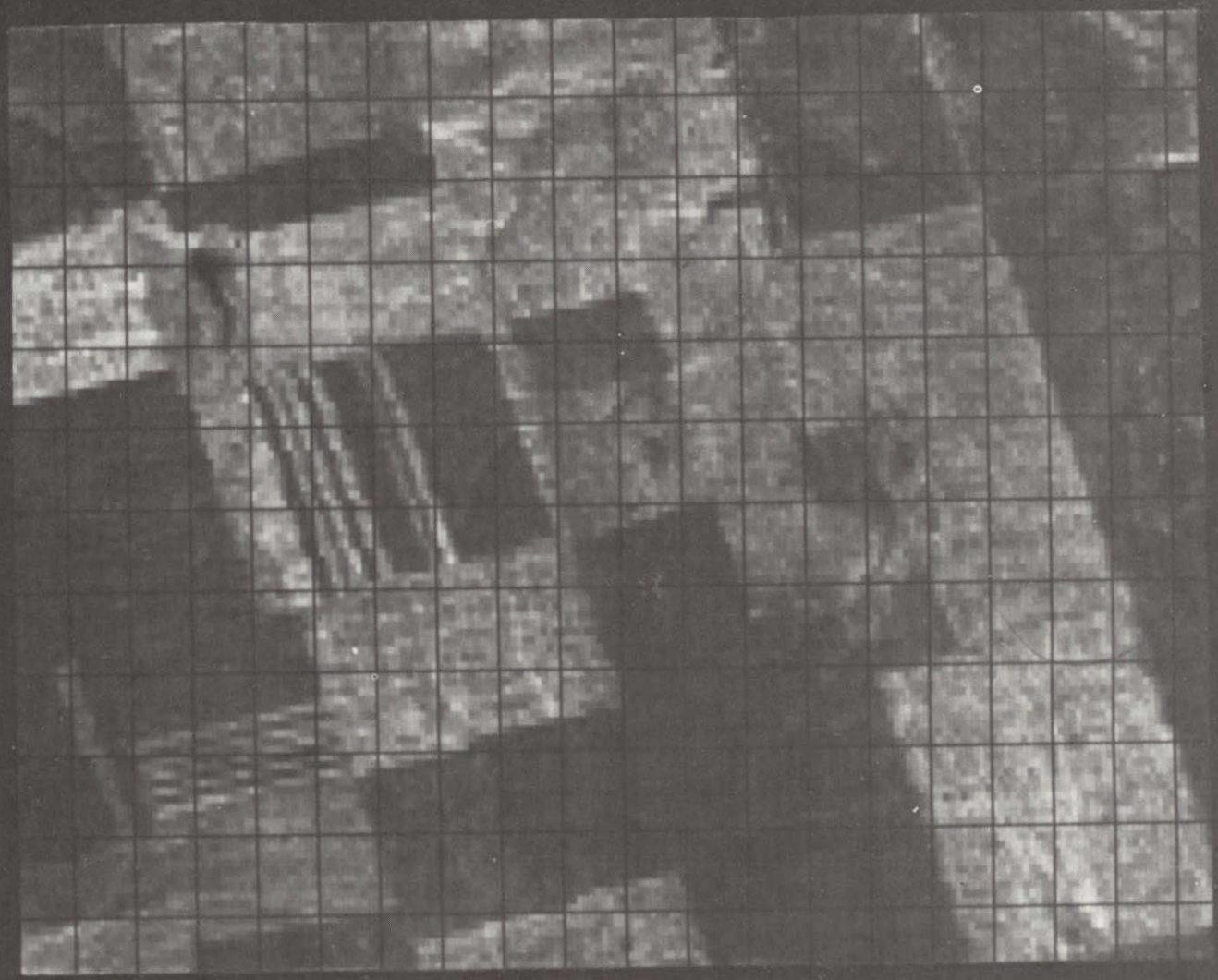
U.S.S.R. WINTER WHEAT

AUG 31, 1976

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NASA-S-78-16482

U.S.S.R. WINTER WHEAT



SEPT 16, 1976

NASA-S-78-16451

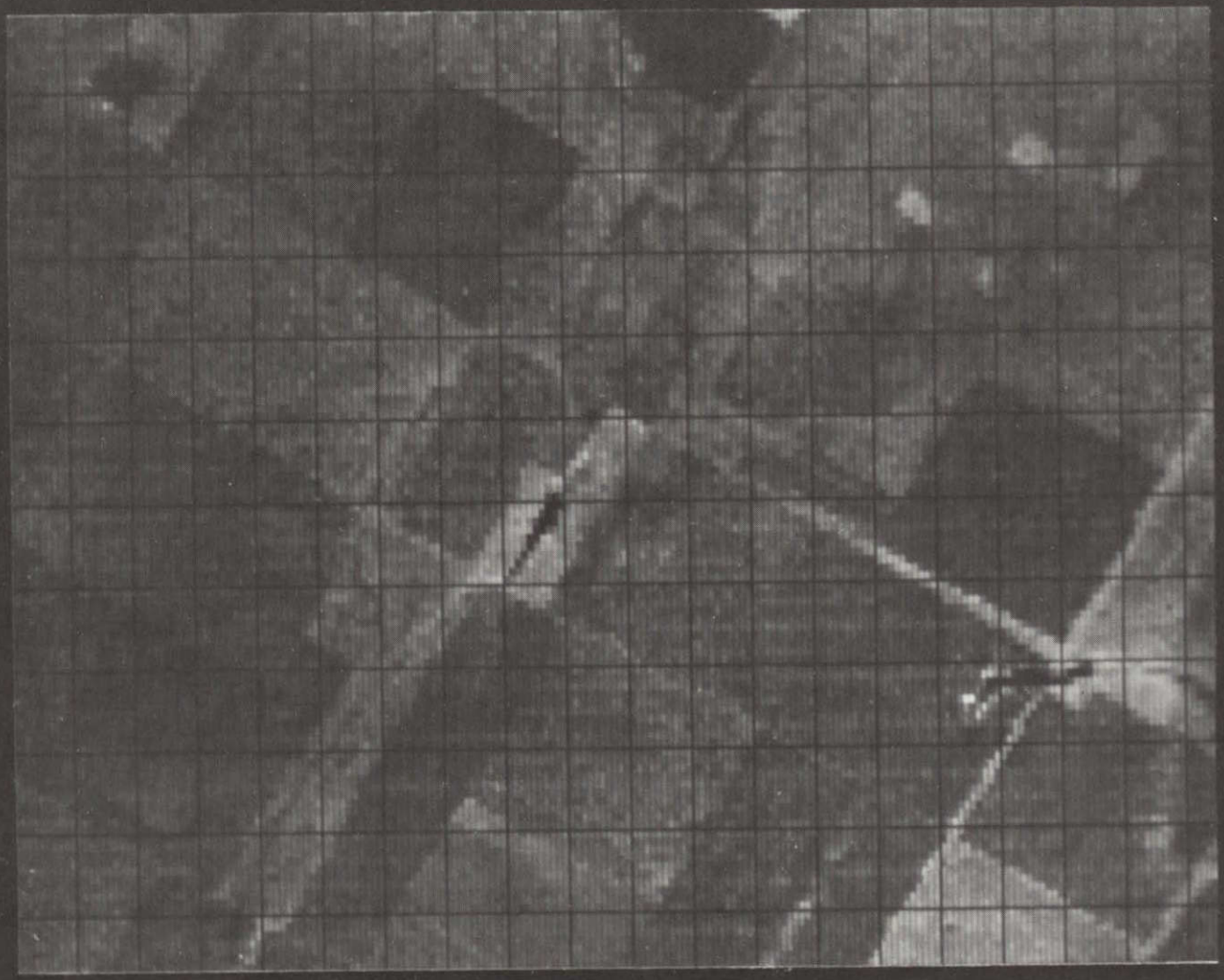
U.S.S.R. SPRING WHEAT



JUNE 19, 1975

NASA-S-78-16438

U.S.S.R. SPRING WHEAT

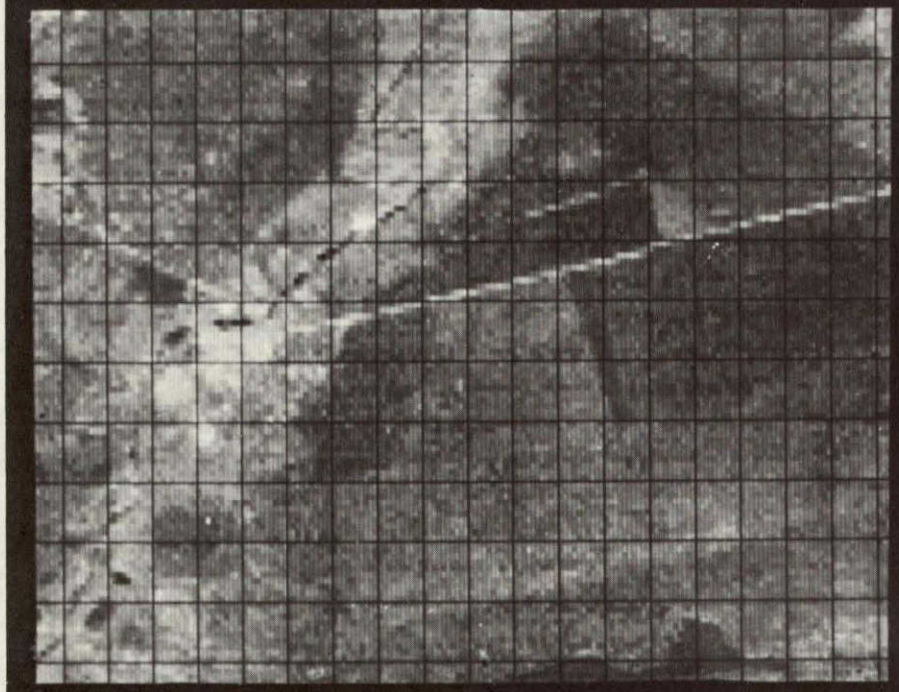


AUG 1, 1976

NASA-S-78-16446

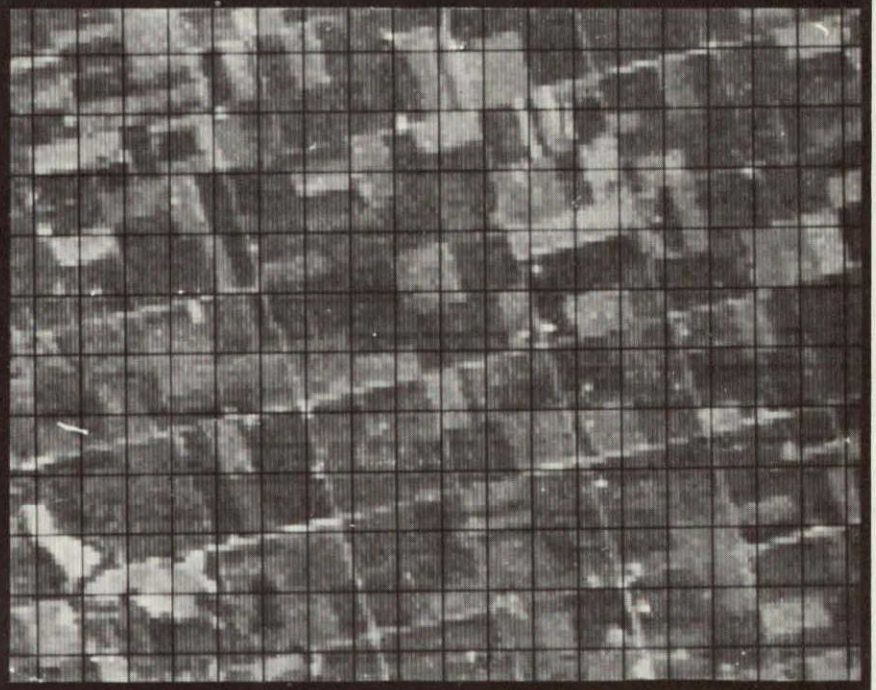
LARGE FIELDS

U.S.S.R.



JUNE 23,1977

U.S.

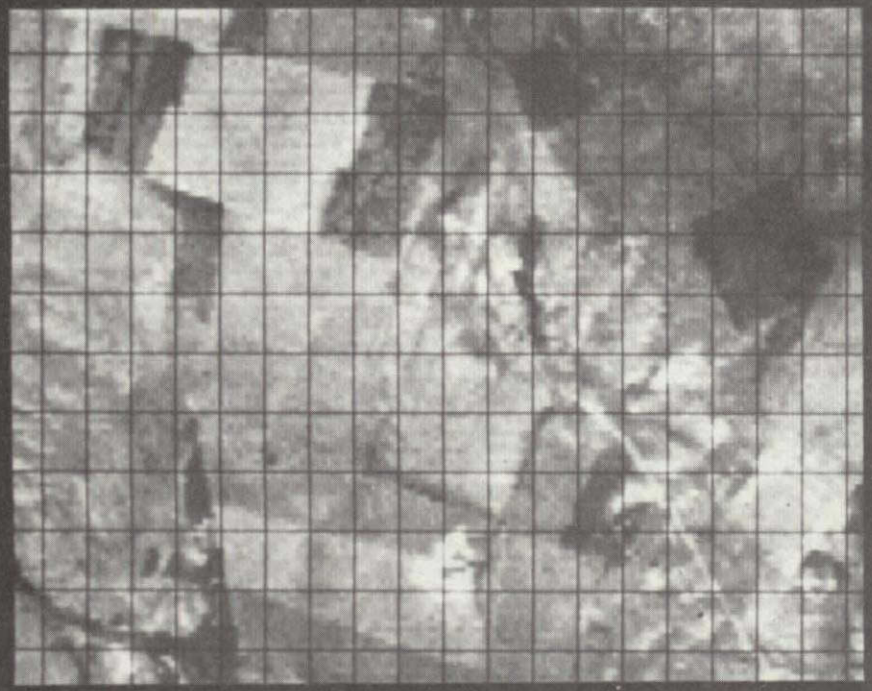


JUNE 24, 1977

NASA-S-78-16450

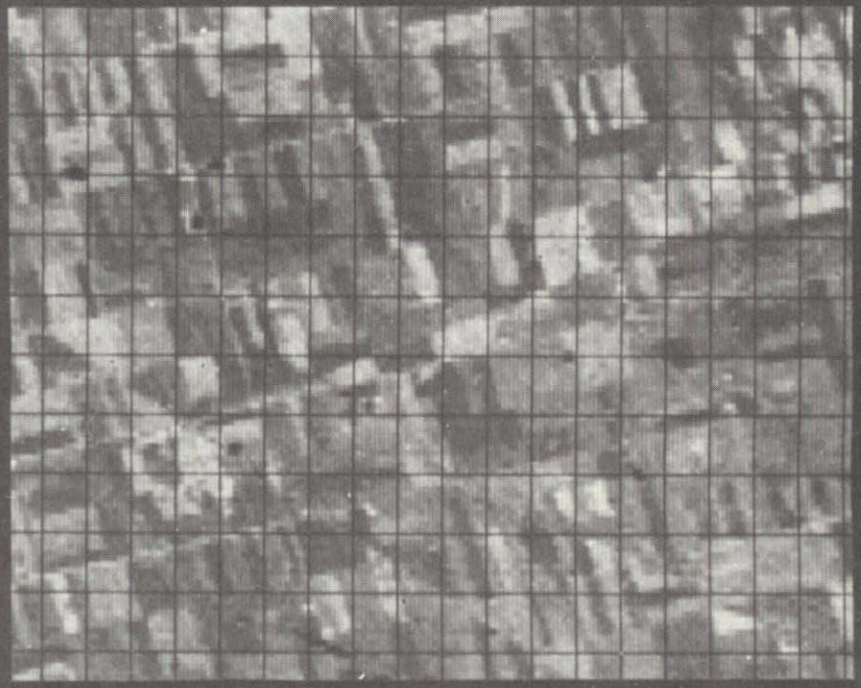
TYPICAL FIELDS

U.S.S.R.



JULY 14, 1977

U.S.

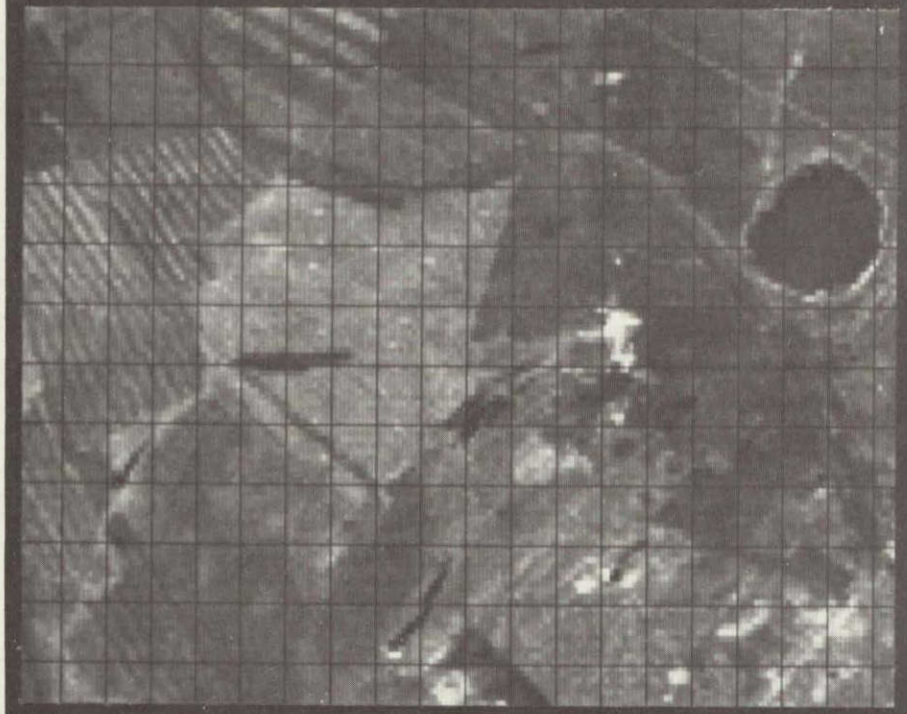


JULY 16, 1977

NASA-S-78-16473

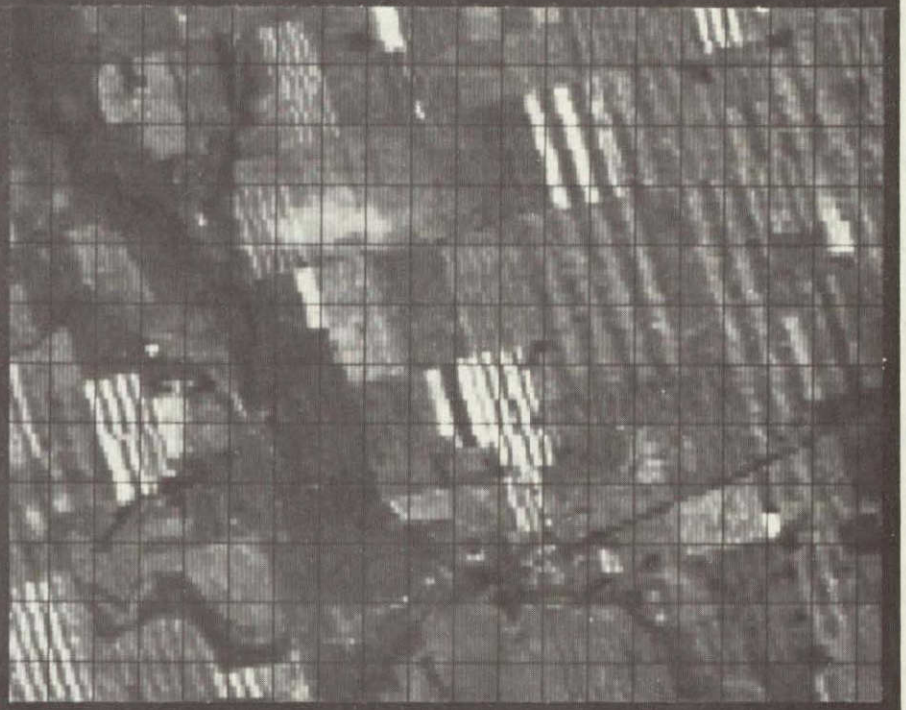
SMALL FIELDS

U.S.S.R.



JULY 4, 1977

U.S.



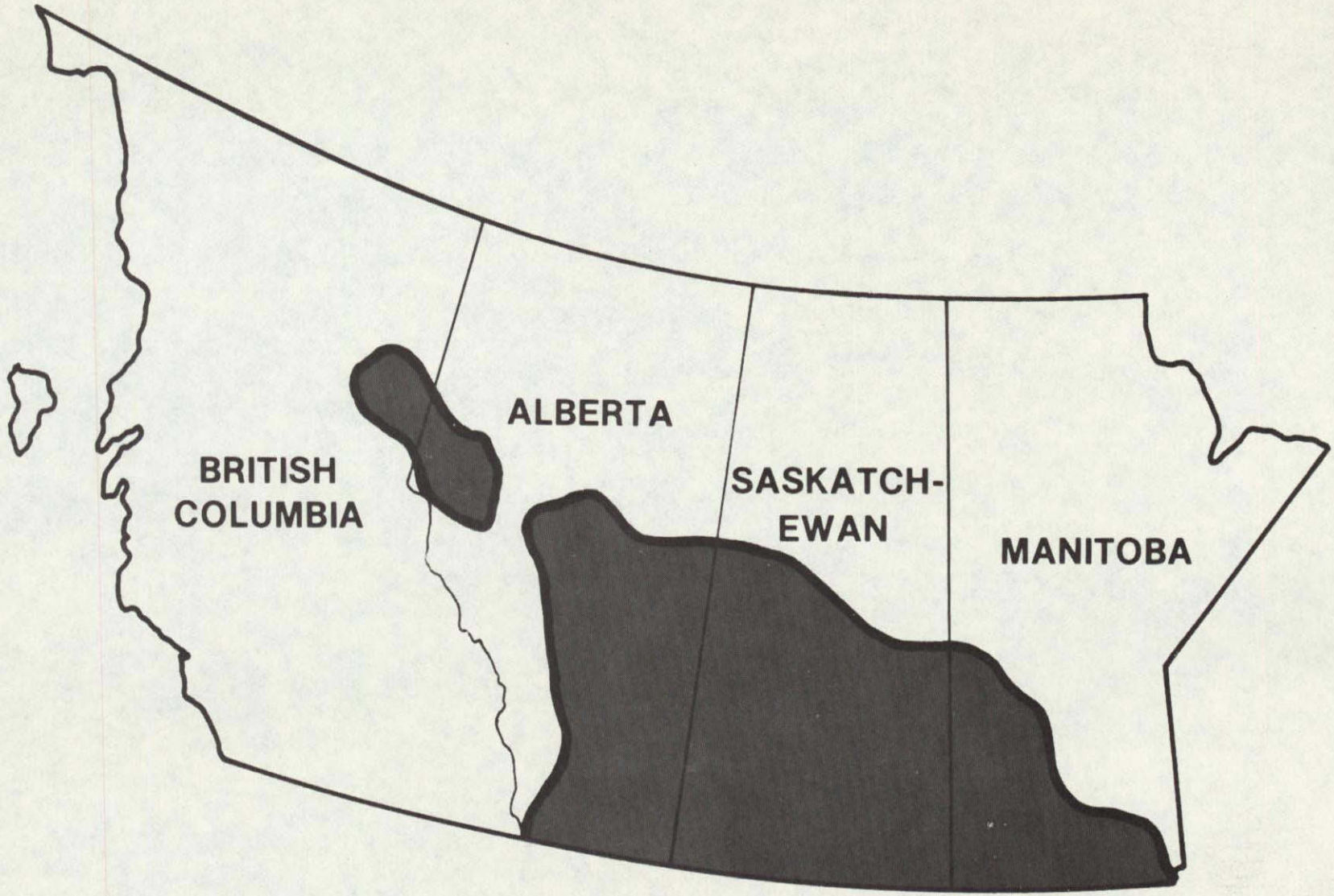
JULY 22, 1977

NASA National Aeronautics and Space Administration

Lyndon B. Johnson Space Center
Houston, Texas 77058

NASA-S-78-16459

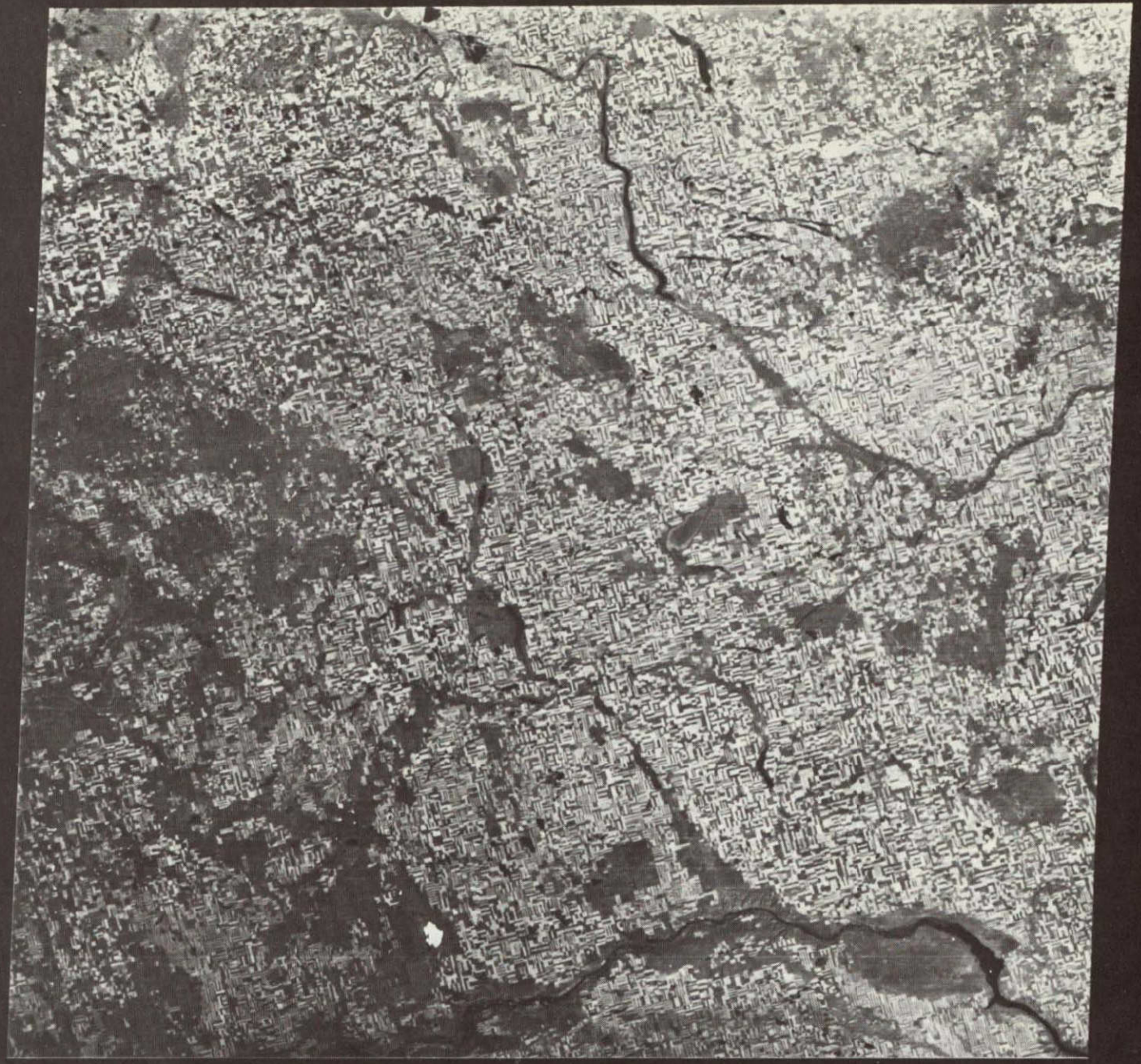
MAJOR WHEAT-PRODUCING REGIONS OF CANADA



NASA-S-78-16461

CANADA SPRING WHEAT

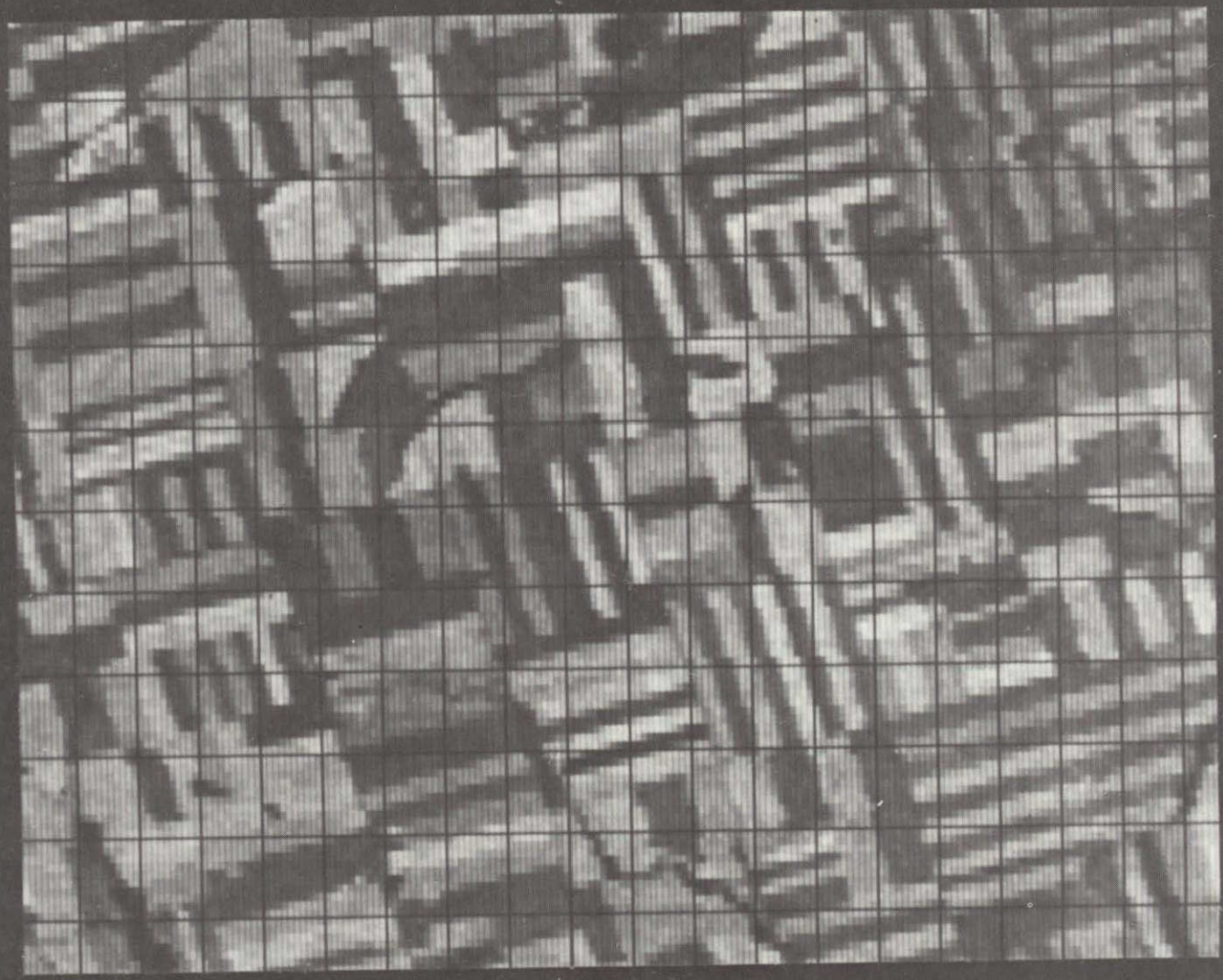
SEPT 19, 1976



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NASA-S-78-16442

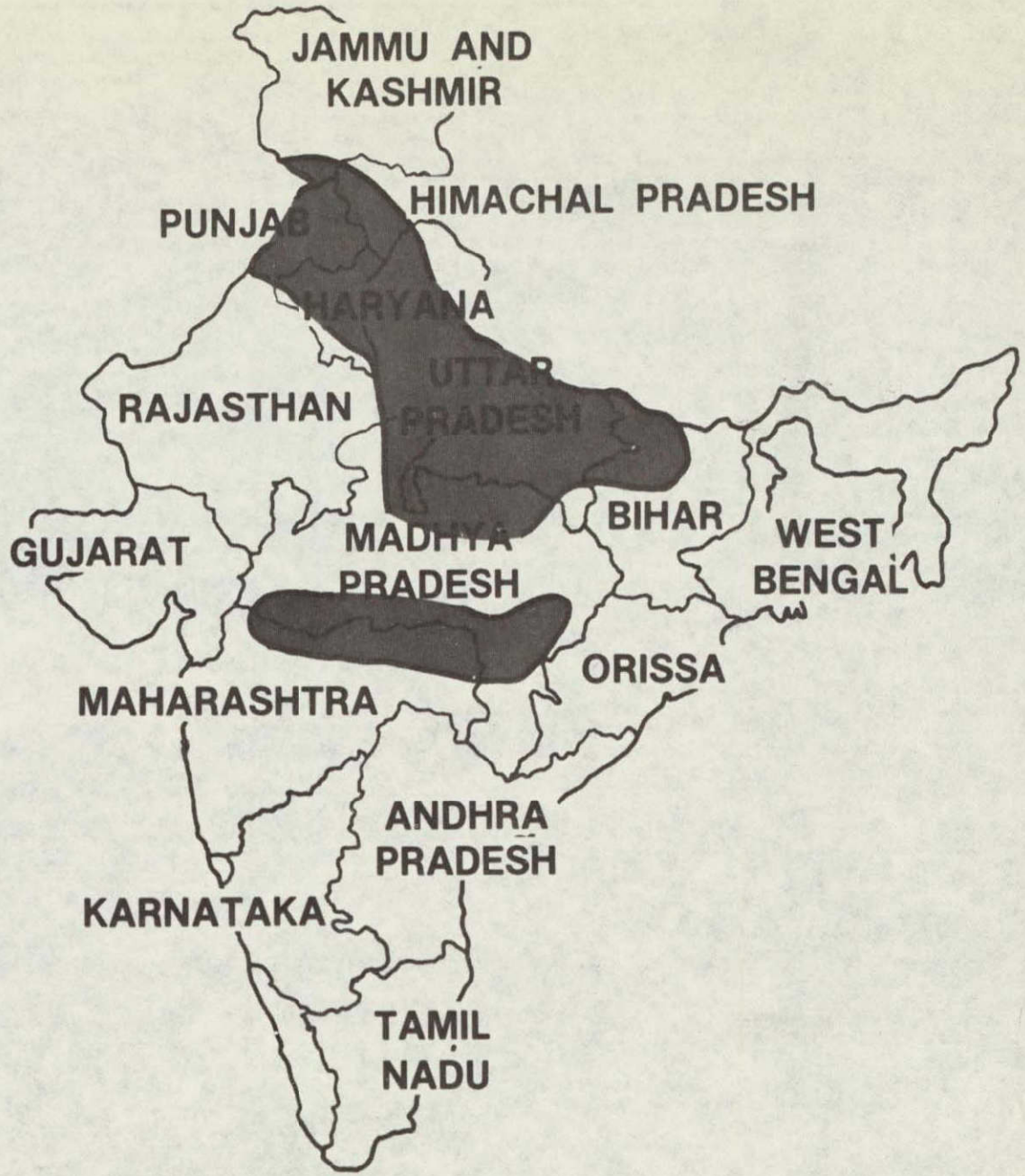
CANADA SPRING WHEAT



SEPT 19, 1976

NASA-S-78-16453

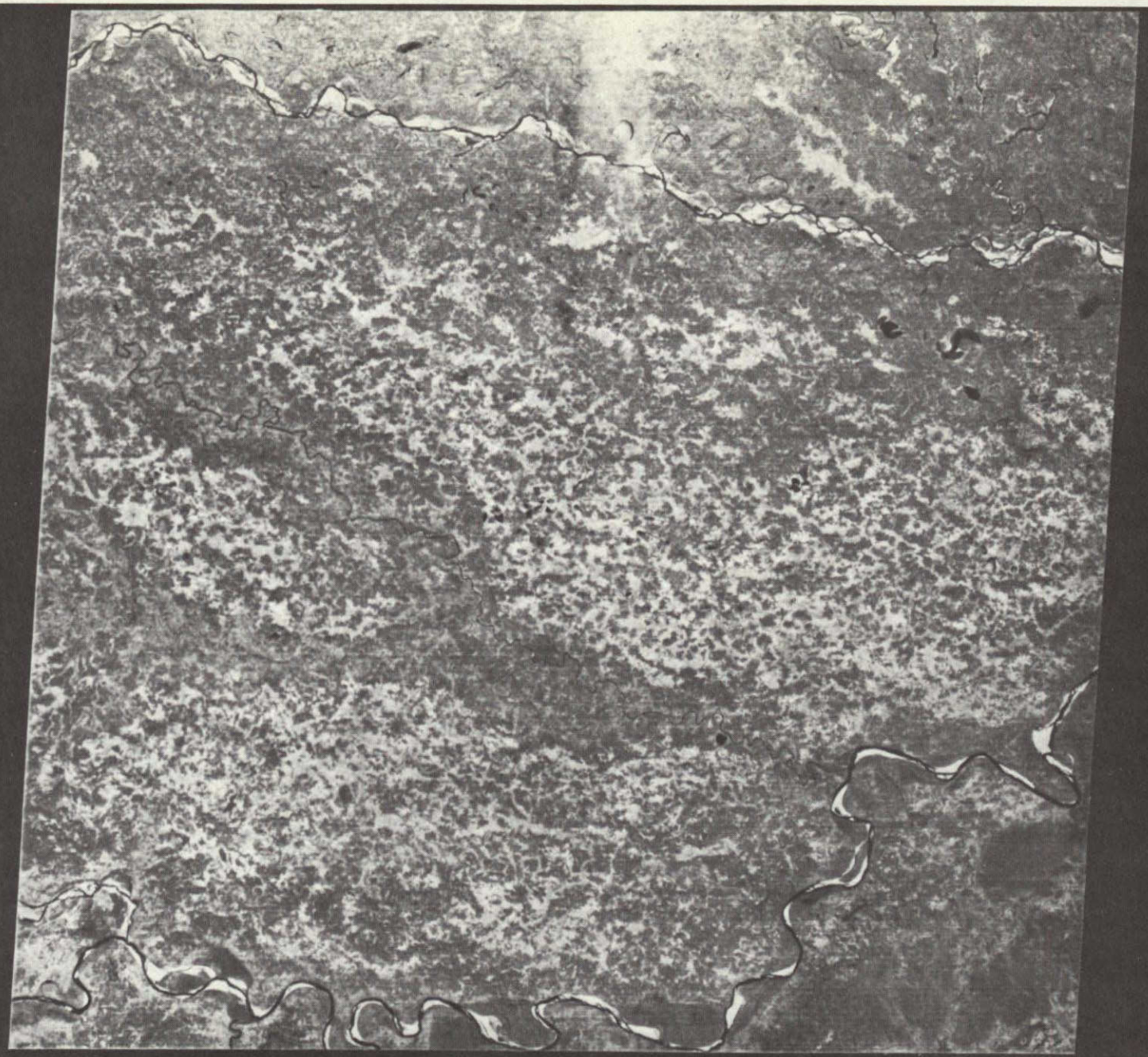
MAJOR WHEAT-PRODUCING REGIONS OF INDIA



NASA-S-78-16463

INDIA
WHEAT

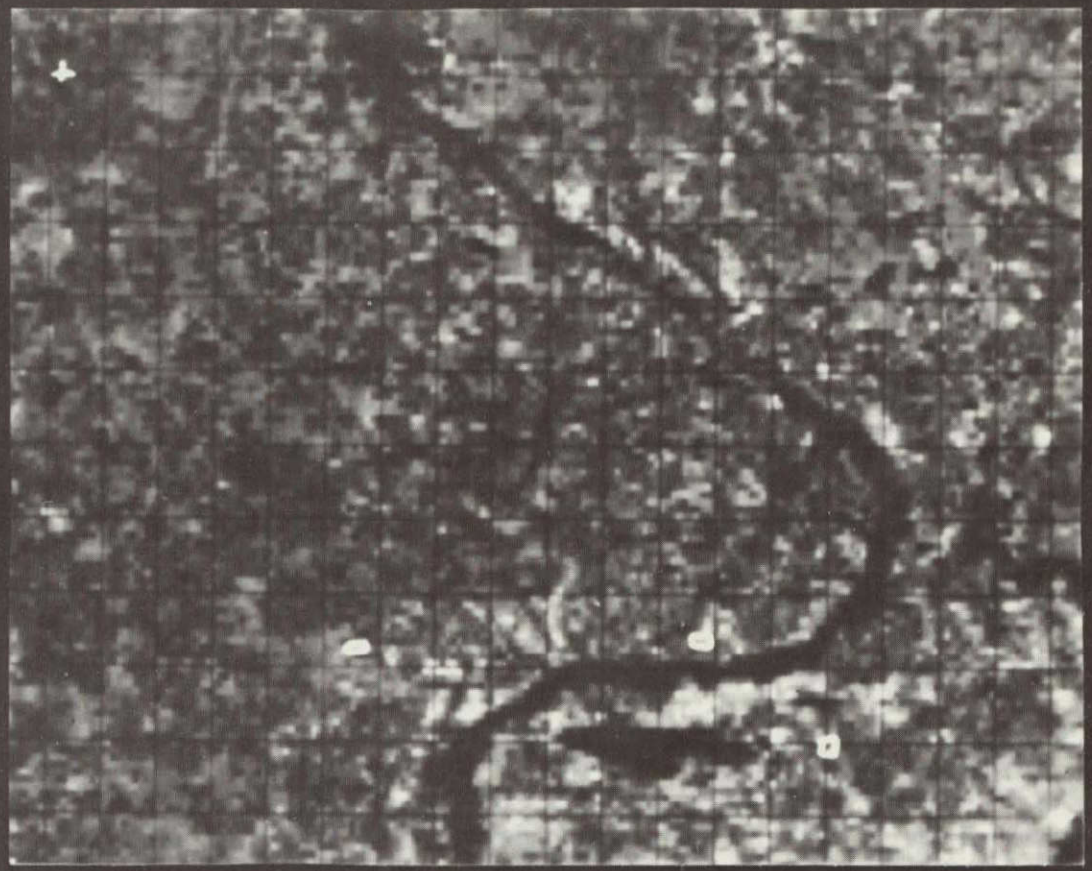
FEB 25, 1975



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NASA-S-78-16448

INDIA WHEAT

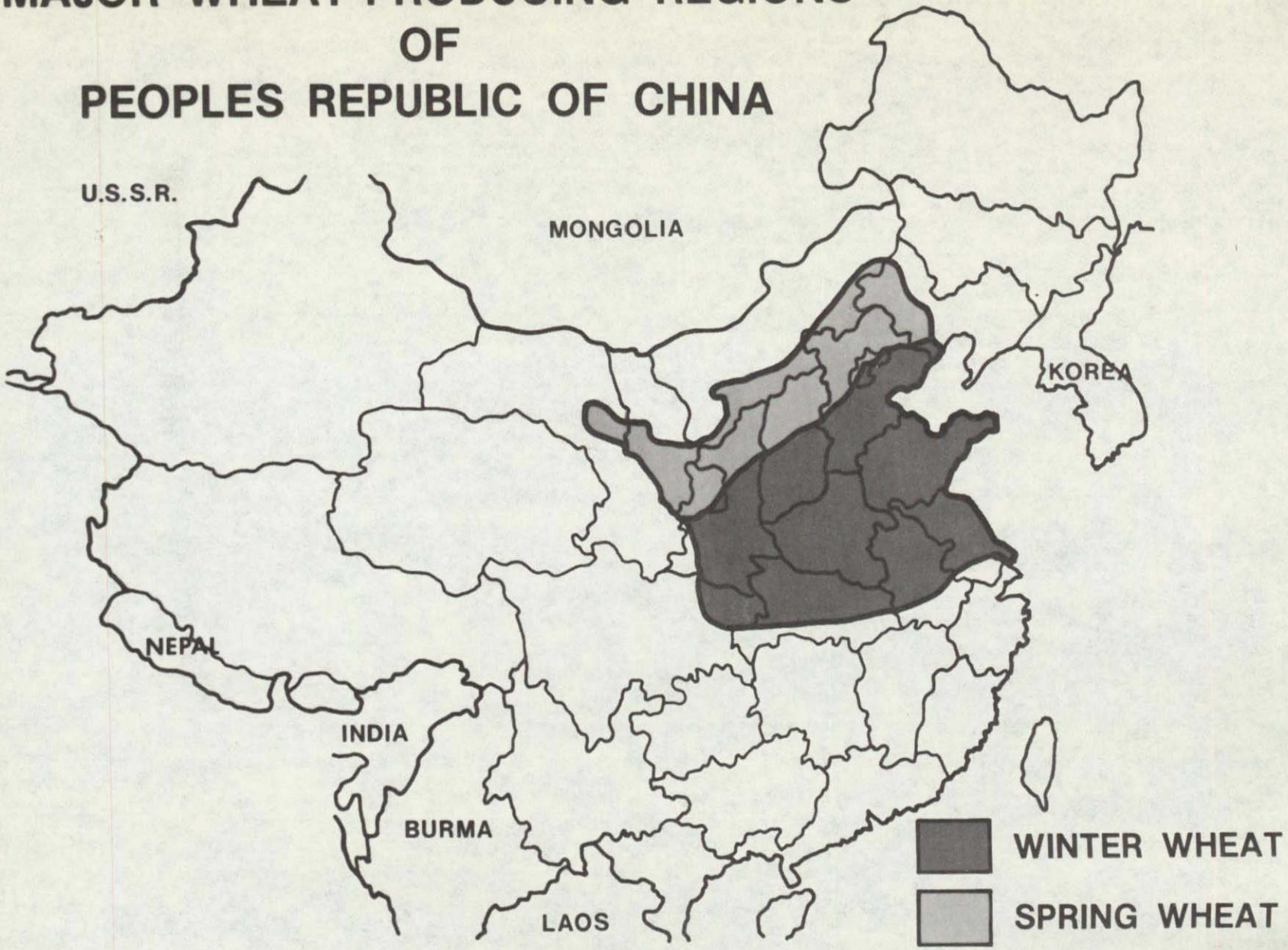


DEC 27, 1975

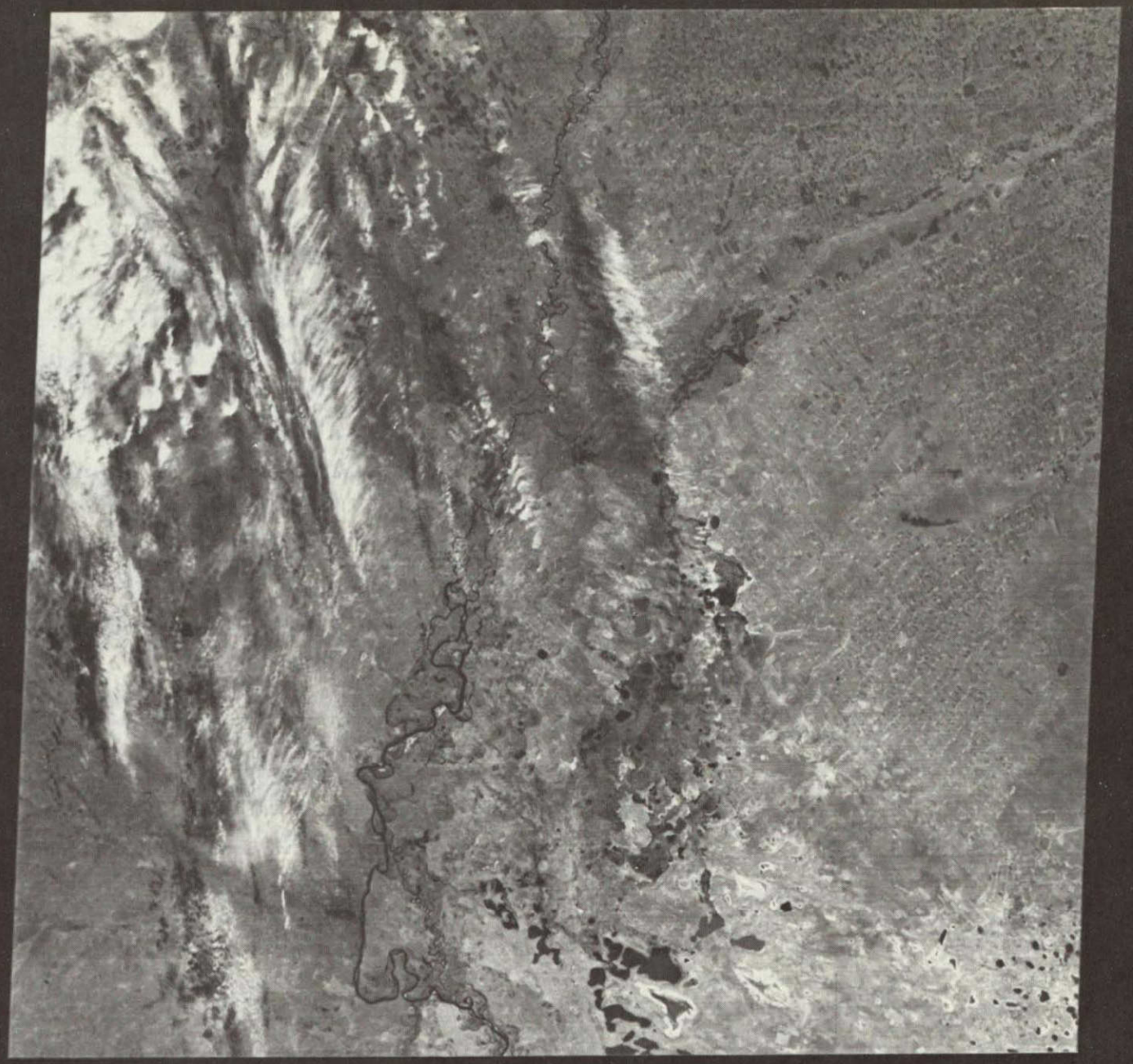
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NASA-S-78-16439

MAJOR WHEAT-PRODUCING REGIONS OF PEOPLES REPUBLIC OF CHINA



NASA-S-78-16476

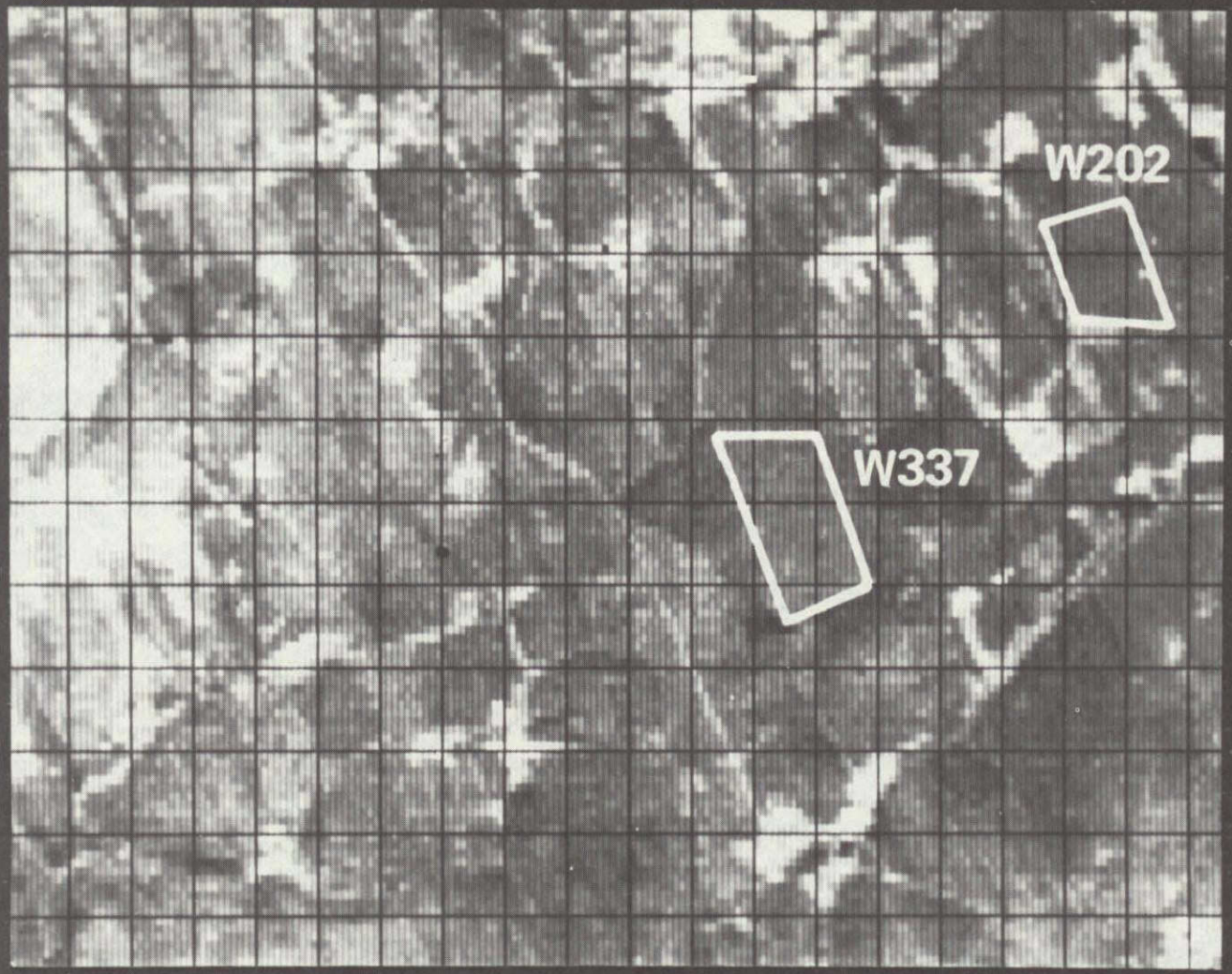


CHINA
WHEAT
LARGE
FIELDS

SEPT 17, 1976

NASA-S-78-16468

CHINA WHEAT - LARGE FIELDS



JUNE 19, 1976

NASA-S-78-16462

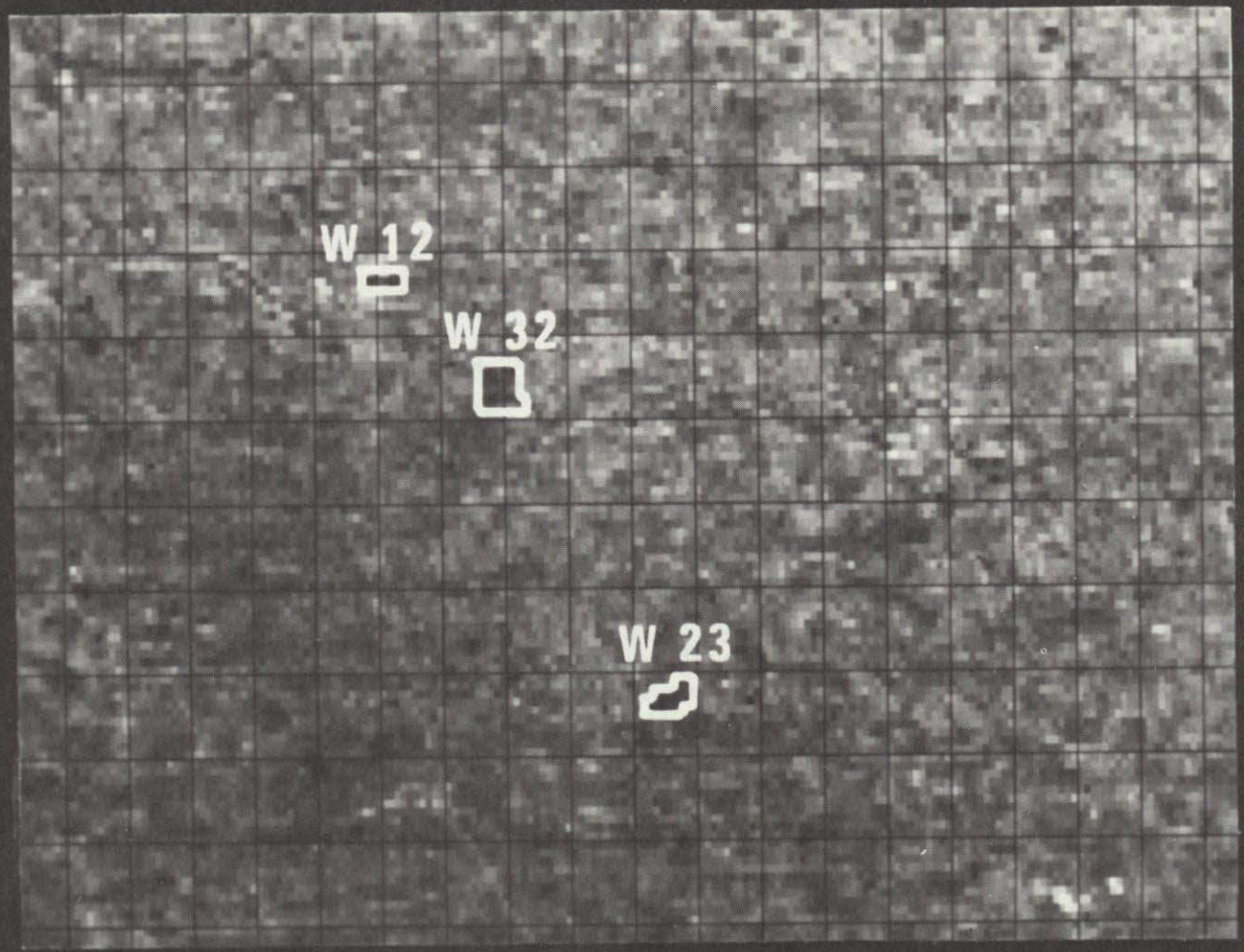


CHINA WHEAT SMALL FIELDS

OCT 30, 1975

NASA-S-78-16441

CHINA WHEAT - SMALL FIELDS



APR 10, 1976

NASA National Aeronautics and Space Administration

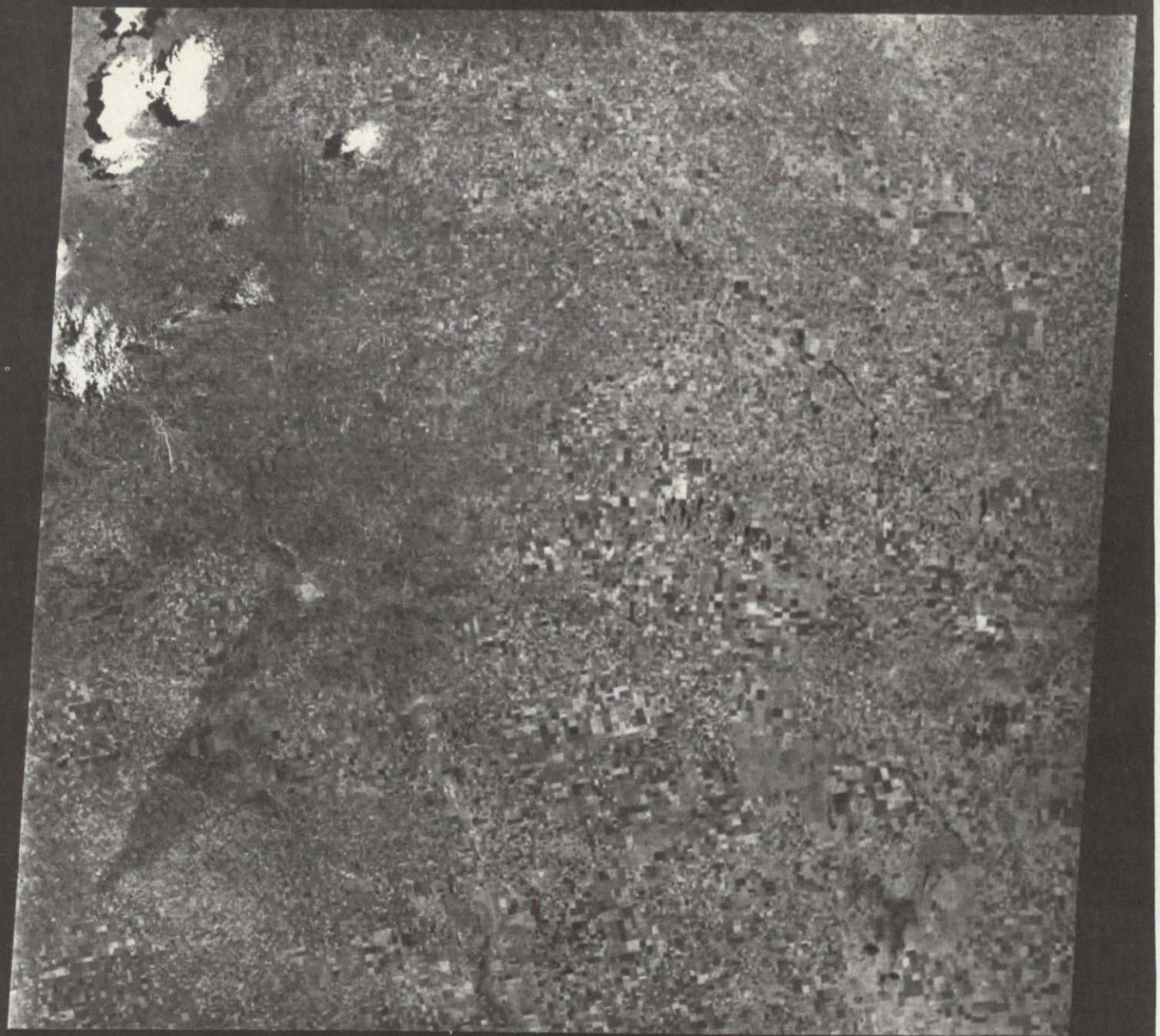
Lyndon B. Johnson Space Center
Houston, Texas 77058

NASA-S-78-16456

MAJOR WHEAT-PRODUCING REGIONS OF ARGENTINA



NASA-S-78-16475

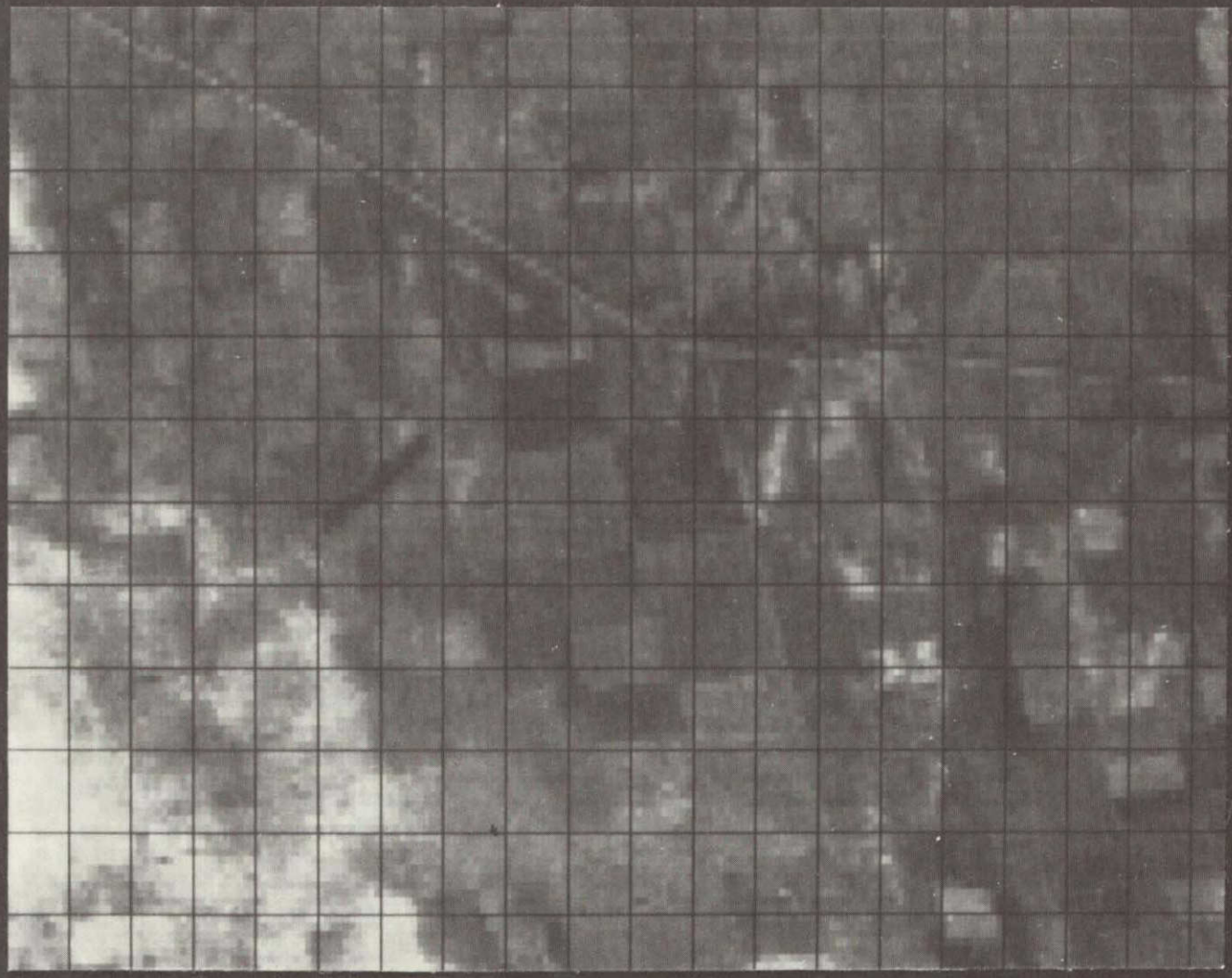


ARGENTINA WHEAT

NOV 18, 1976

NASA-S-78-16470

ARGENTINA WHEAT



OCT 27, 1977

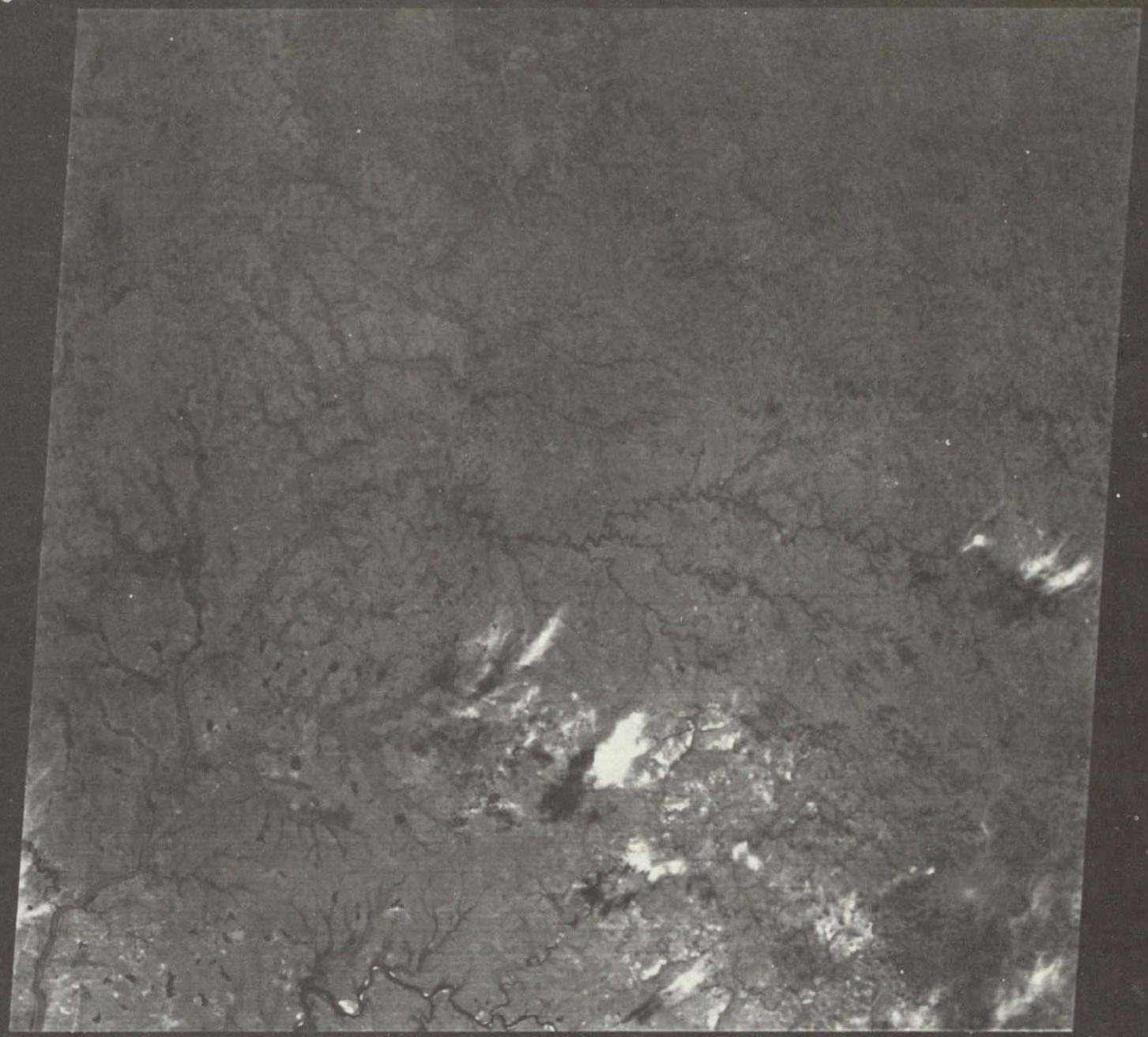
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NASA-S-78-16443

MAJOR WHEAT-PRODUCING REGIONS OF BRAZIL



NASA-S-78-16480

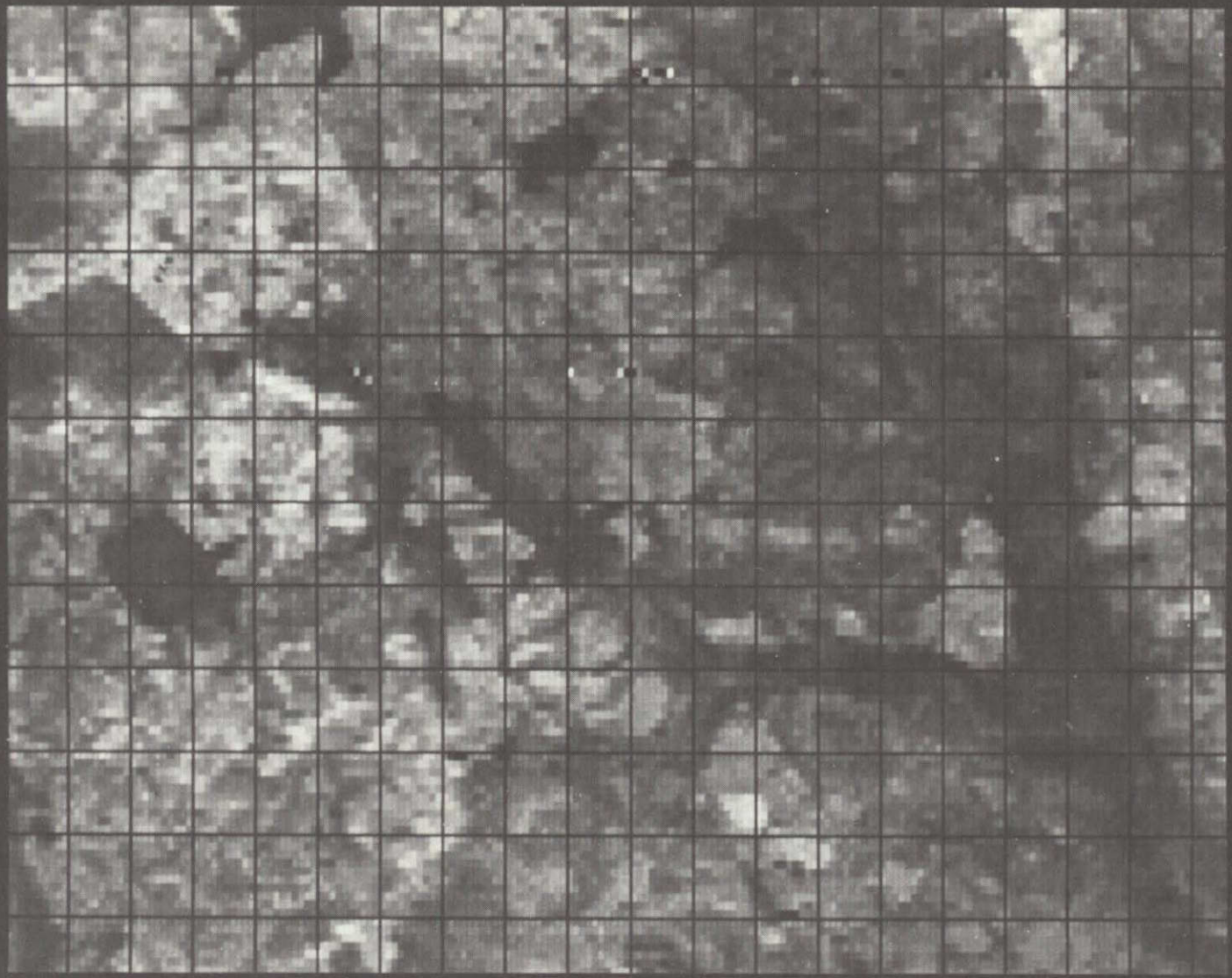


BRAZIL
WHEAT

MAR 13, 1973

NASA-S-78-16464

BRAZIL WHEAT

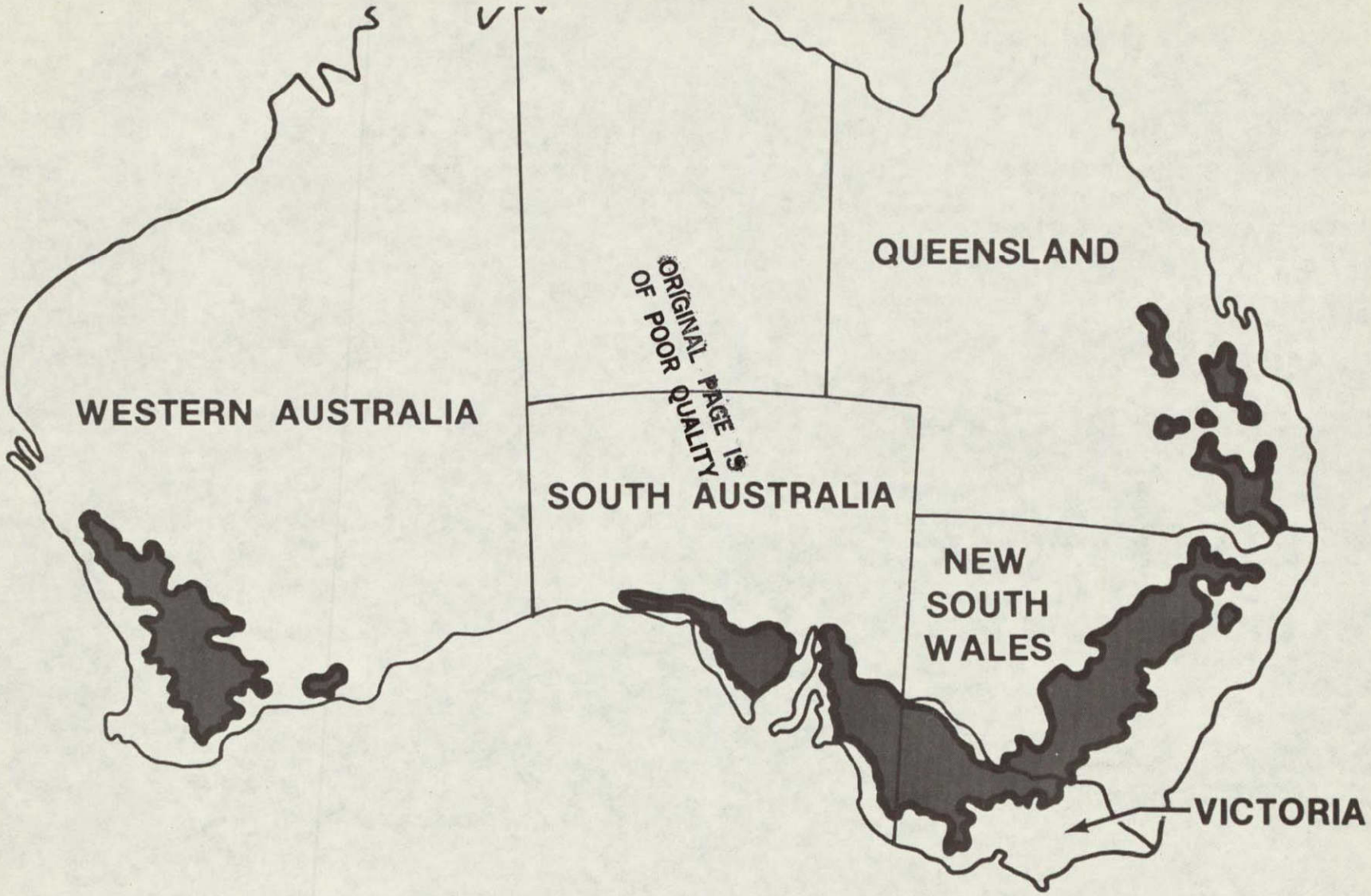


NOV 26, 1977

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NASA-S-78-16457

MAJOR WHEAT-PRODUCING REGIONS OF AUSTRALIA



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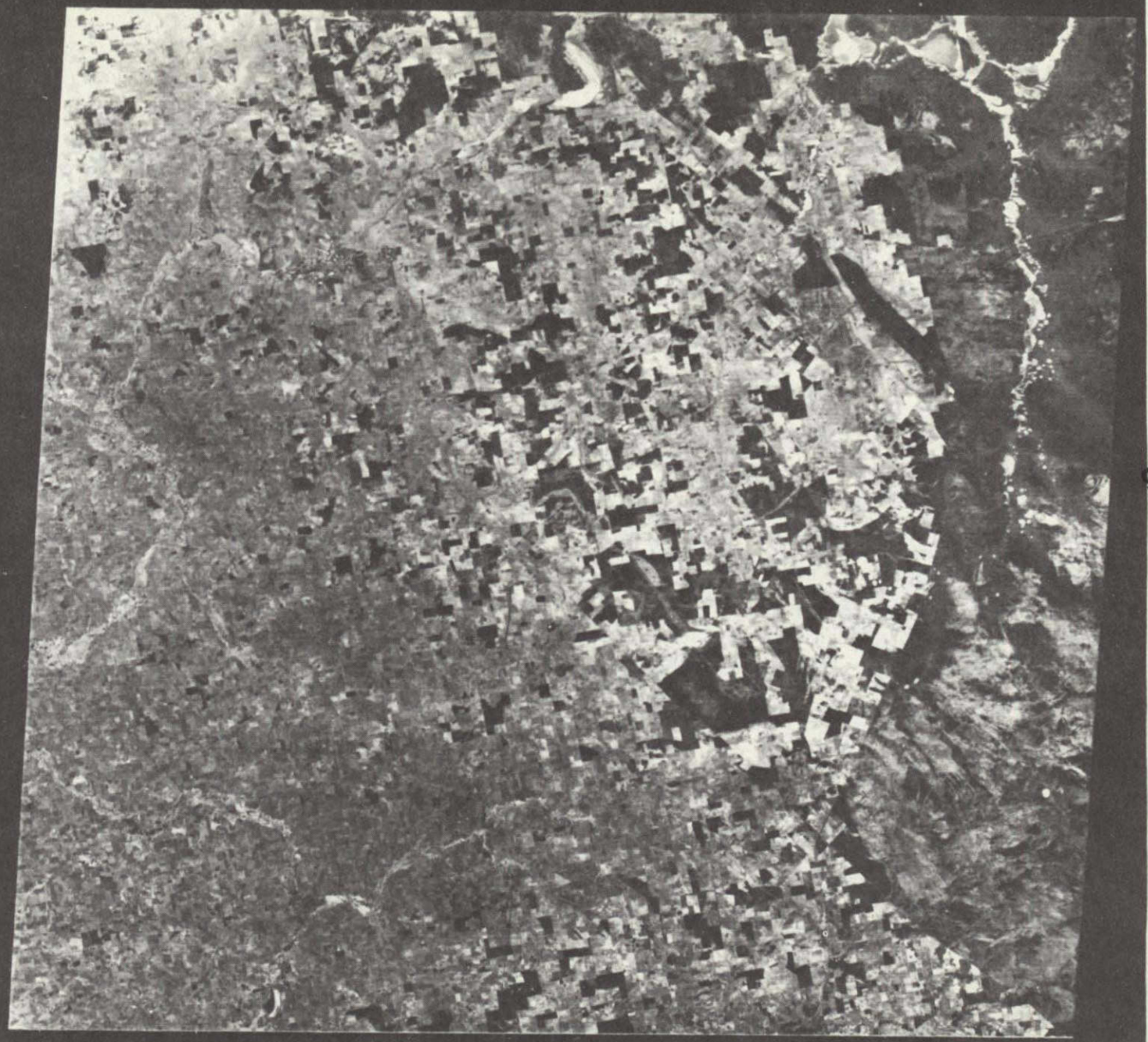
NASA National Aeronautics and Space Administration

Lyndon B. Johnson Space Center
Houston, Texas 77058

NASA-S-78-16437

AUSTRALIA WHEAT

SEPT 24, 1976

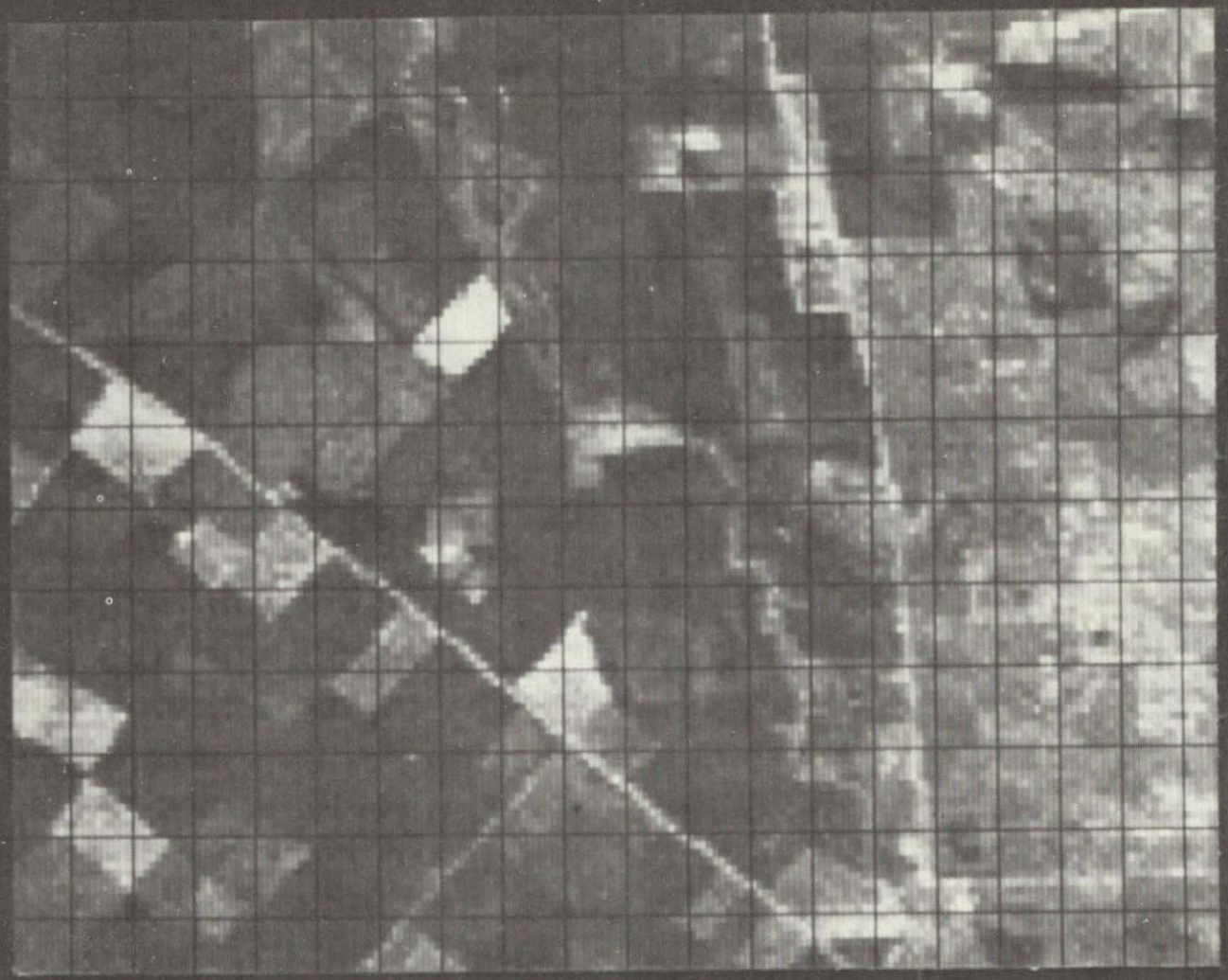


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C-2

NASA-S-78-16436

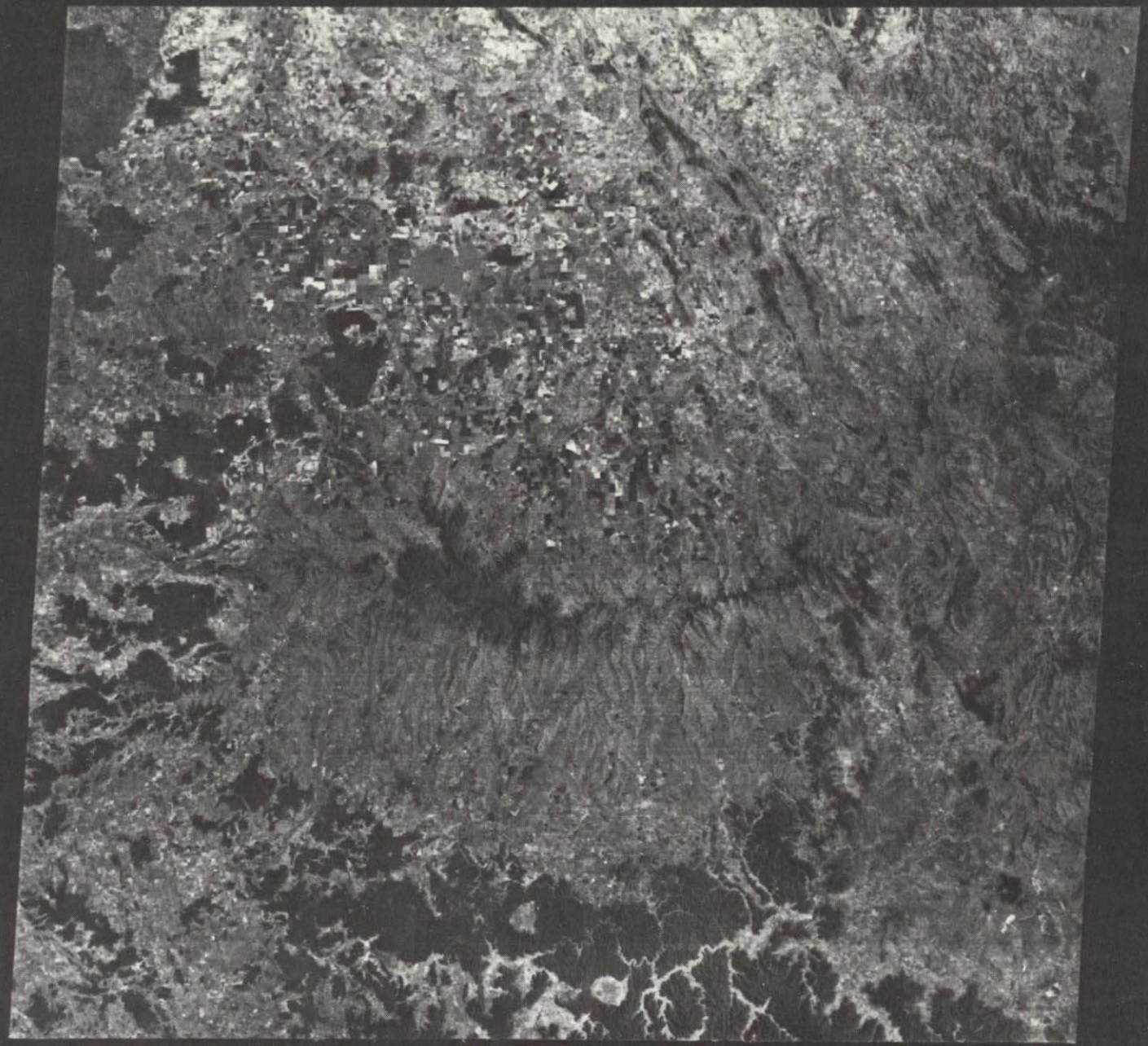
AUSTRALIA WHEAT



AUG 27, 1977

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NASA-S-78-16483



AUSTRALIA WHEAT

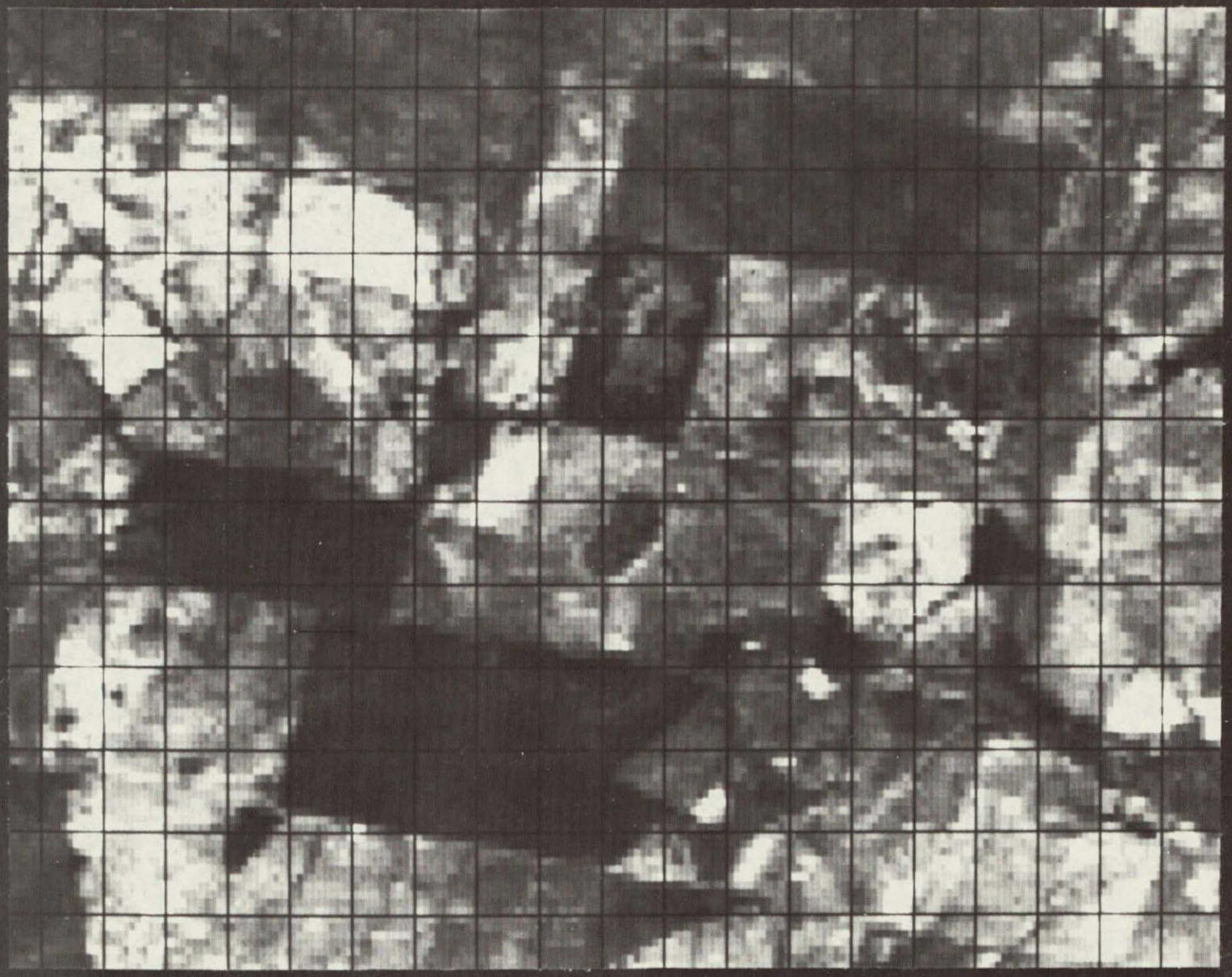
NOV 30, 1976

NASA National Aeronautics and Space Administration

Lyndon B. Johnson Space Center
Houston, Texas 77058

NASA-S-78-16472

AUSTRALIA WHEAT



FEB 28, 1978

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National Aeronautics and Space Administration

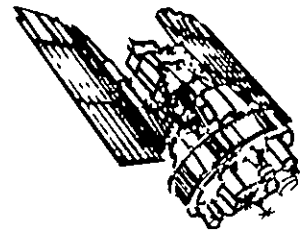
Lyndon B Johnson Space Center
Houston Texas 77058

NASA-S-78-16827

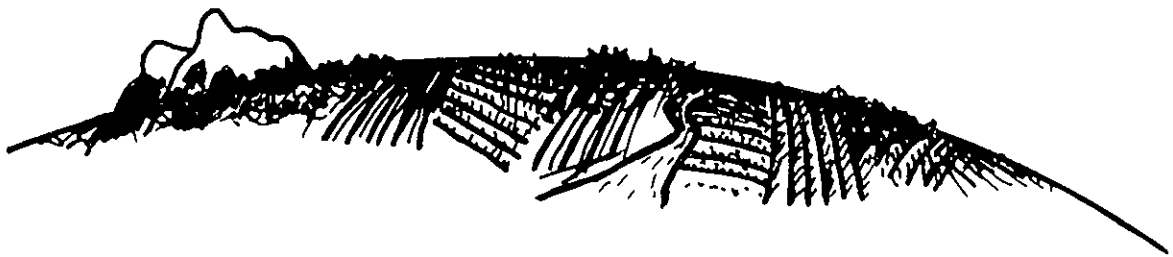
LACIE TECHNICAL APPROACH

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NASA-S-78-16820



LACIE OBJECTIVES



- DEMONSTRATE AN IMPORTANT APPLICATION OF REPETITIVE MULTISPECTRAL REMOTE SENSING FROM SPACE

- TEST THE CAPABILITY OF LANDSAT, TOGETHER WITH CLIMATOLOGICAL, METEOROLOGICAL, AND CONVENTIONAL DATA SOURCES, TO ESTIMATE THE PRODUCTION OF AN IMPORTANT WORLD CROP

- VALIDATE TECHNOLOGY TO PROVIDE USEFUL ESTIMATES OF CROP PRODUCTION

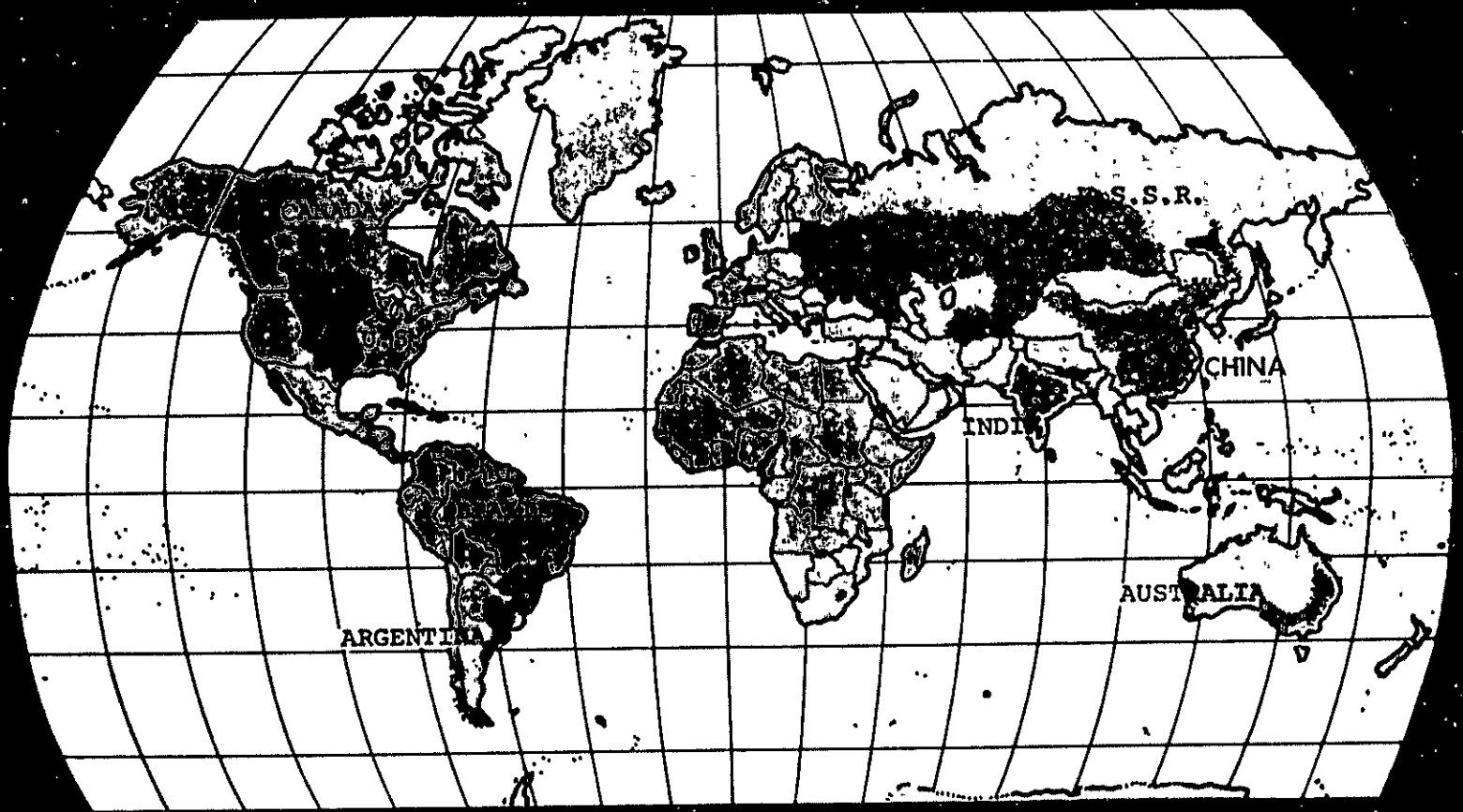
NASA-S-78-16819

LACIE PERFORMANCE GOALS

- ACCURACY
  - WITHIN 10 PERCENT OF "TRUE" PRODUCTION 90 PERCENT OF THE TIME AT HARVEST (90/90)
  - COUNTRY LEVEL
  - DETERMINE ACCURACY OF EARLY ESTIMATES
- TIMELINESS
  - DATA AVAILABLE FOR ANALYSIS 14 DAYS AFTER ACQUISITION BY LANDSAT

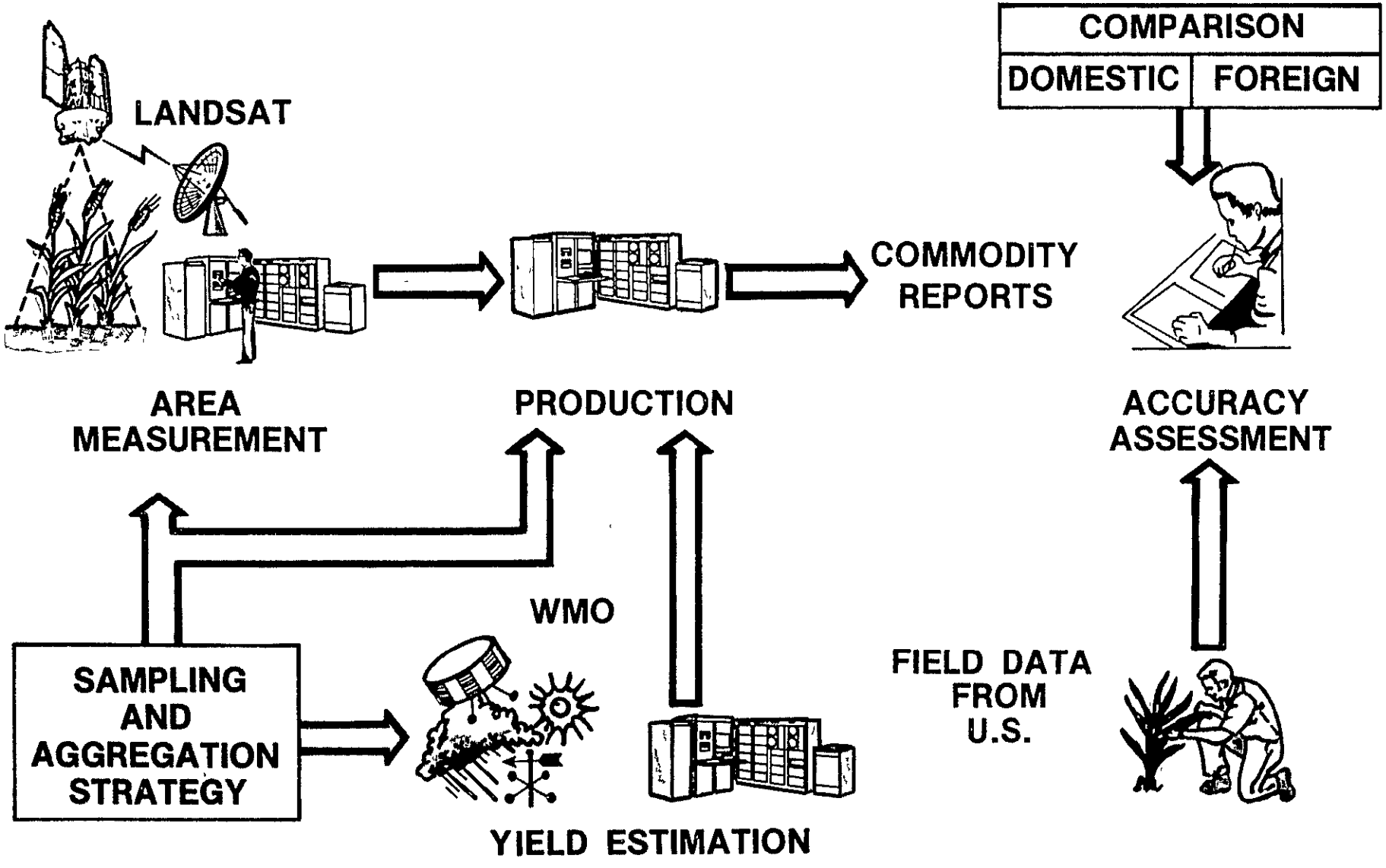
NASA-S-78-16800

MAJOR WHEAT-PRODUCING REGIONS CONSIDERED IN LACIE



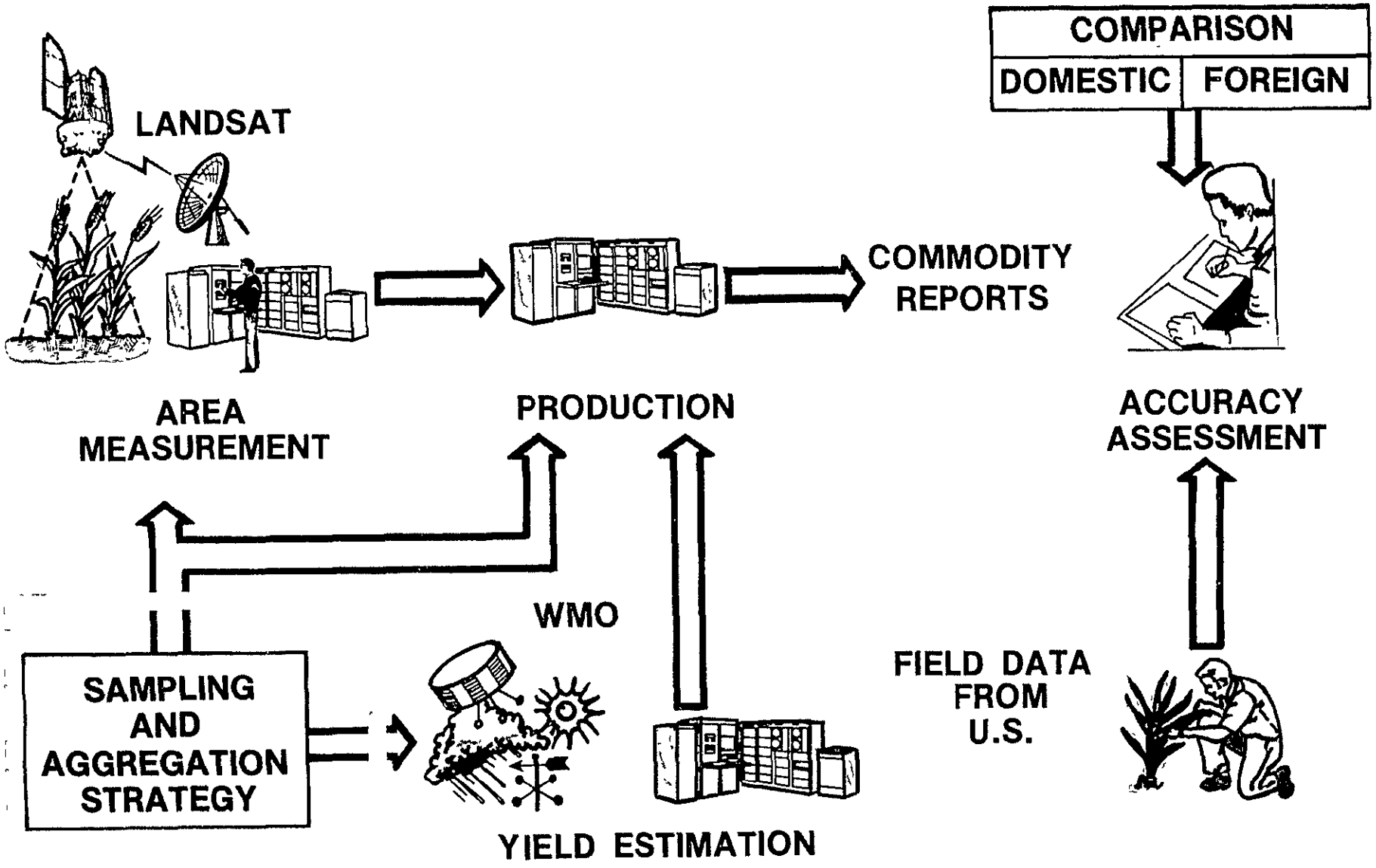
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TECHNICAL IMPLEMENTATION



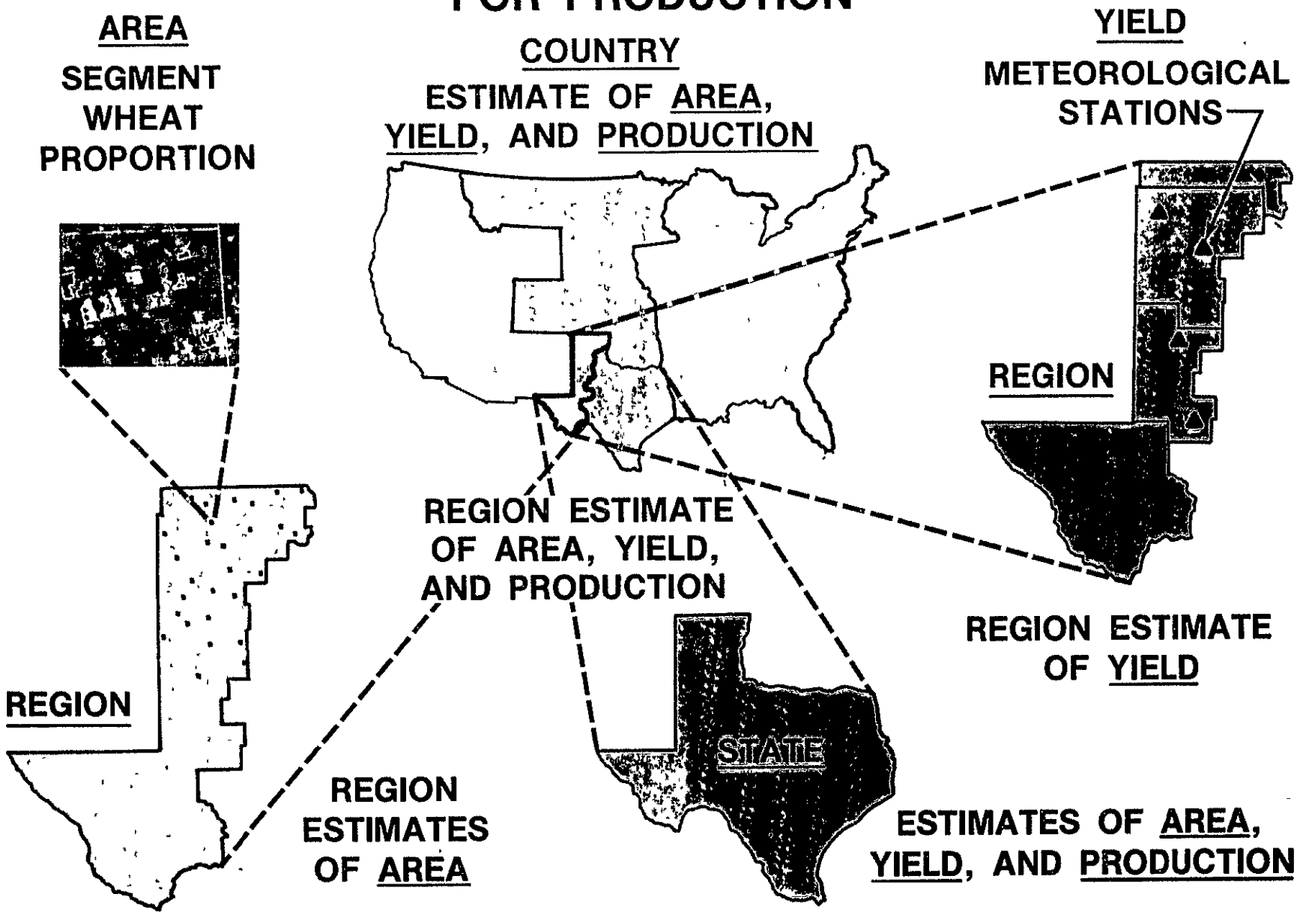
NASA-S-78-16804

TECHNICAL IMPLEMENTATION

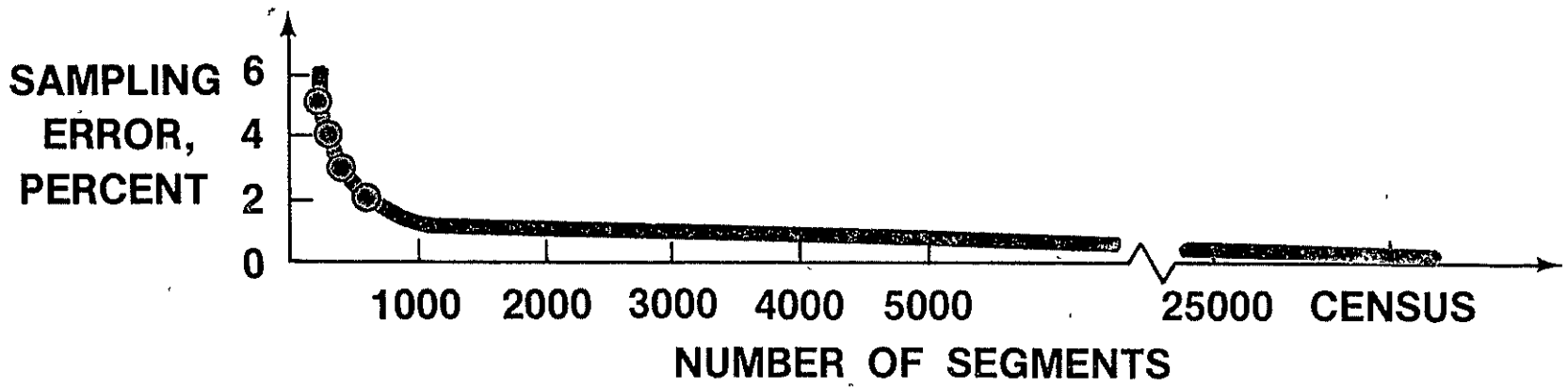


NASA-S-78-16807

SAMPLING AND AGGREGATION STRATEGY FOR PRODUCTION

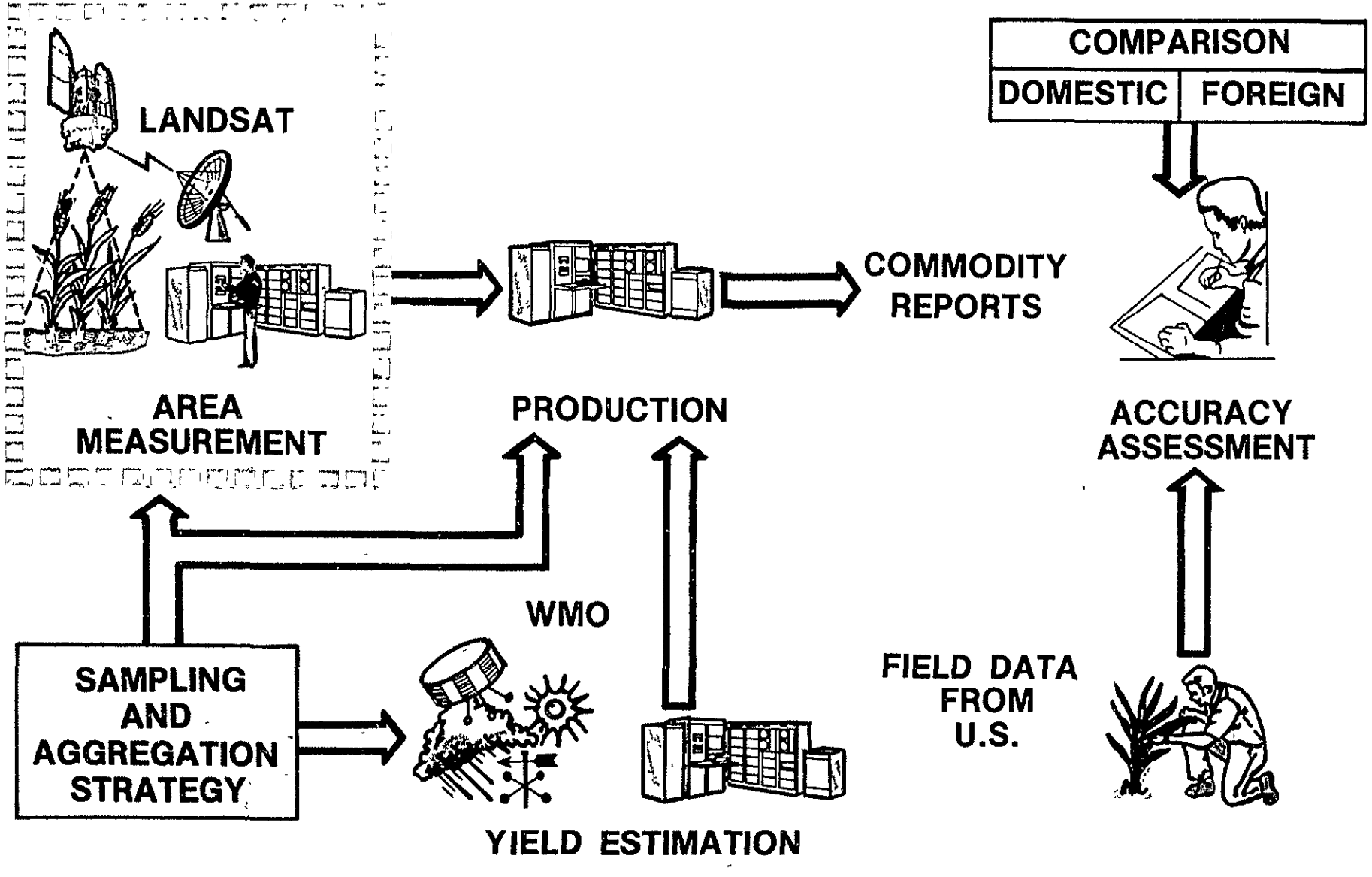


SAMPLING ERROR VERSUS NUMBER OF SEGMENTS



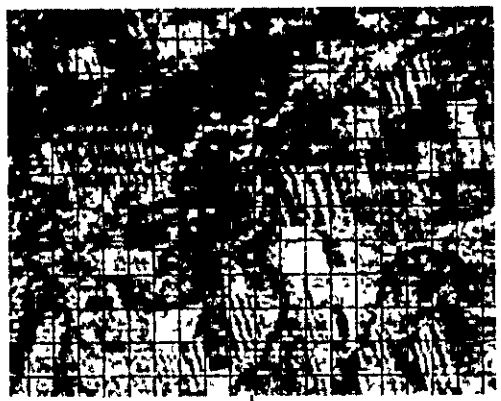
TECHNICAL IMPLEMENTATION

NASA-S-78-16806

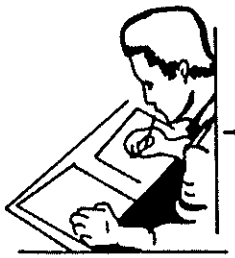


NASA-S-78-16816

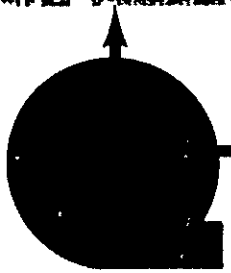
AREA ESTIMATION



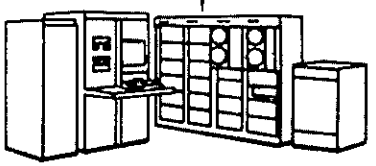
ANALYST



● LABELING



PROPORTION ESTIMATE



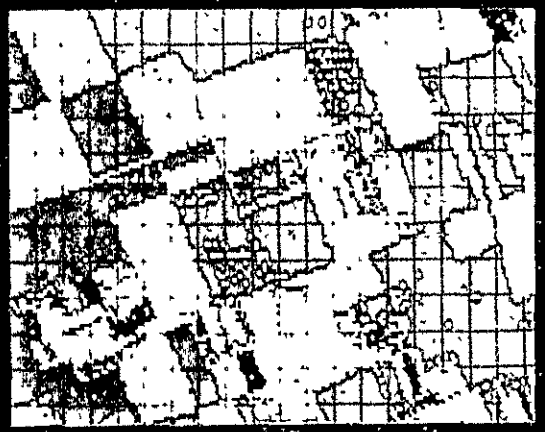
COMPUTER

NASA-S-78-16826

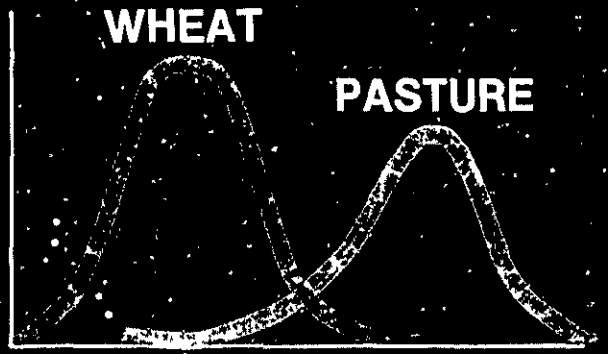
MACHINE CLASSIFICATION



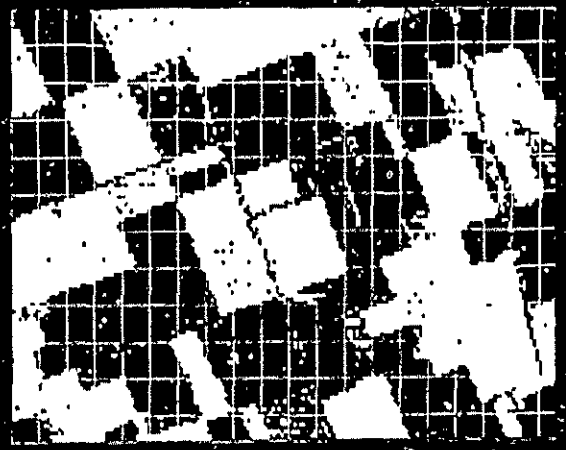
LANDSAT SEGMENTS



CLUSTERING



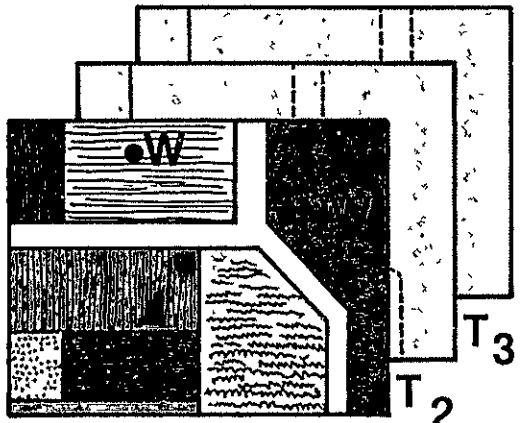
MULTIVARIATE GAUSSIAN DISTRIBUTION



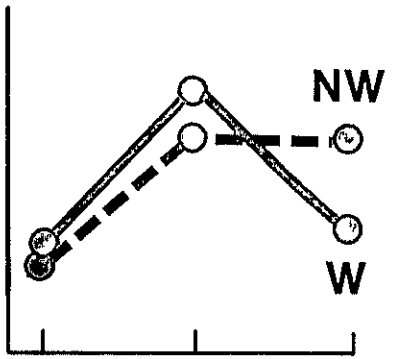
CLASSIFICATION

NASA-S-78-16821

ANALYST LABELING
WITHOUT GROUND TRUTH

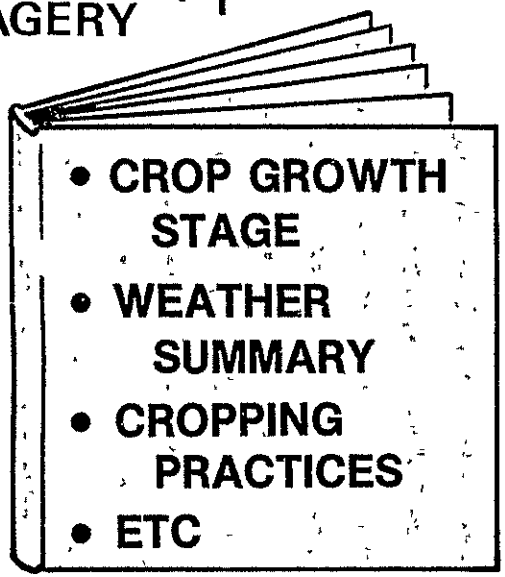


LANDSAT IMAGERY T_1



LANDSAT RESPONSE

DIGITAL DATA

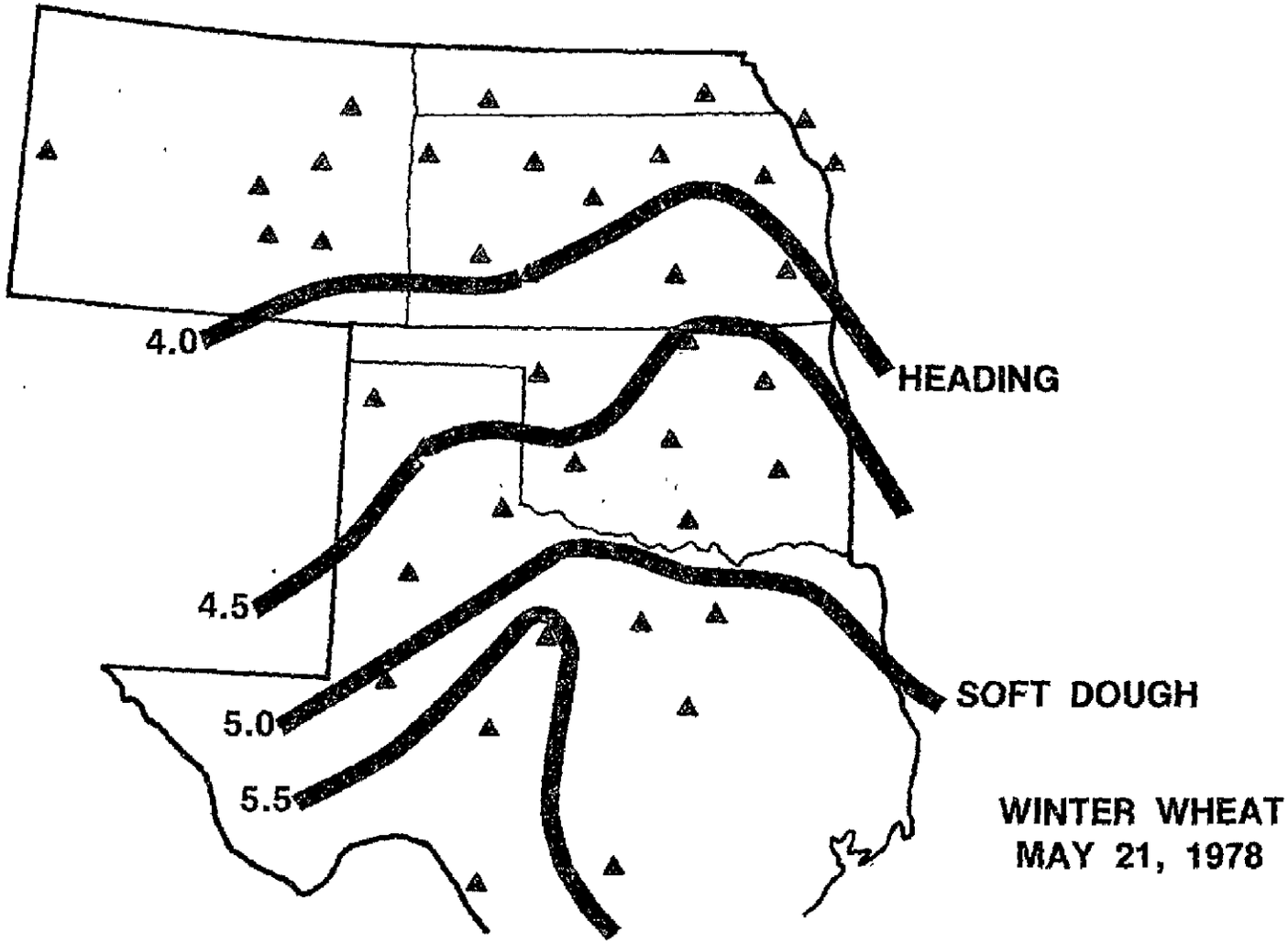


ANCILLARY DATA



NASA-S-78-1681

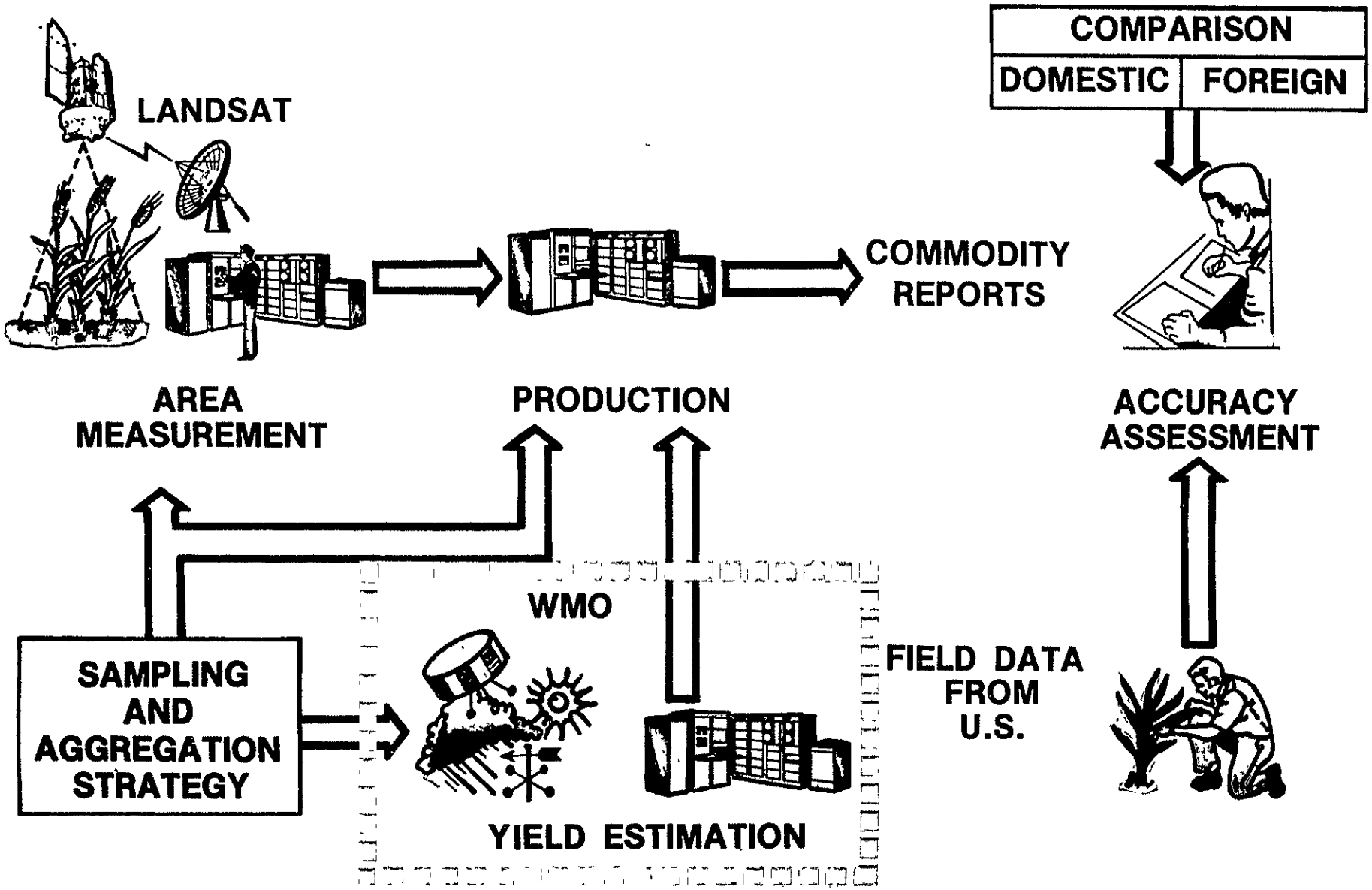
WHEAT GROWTH STAGE MODELS



MATURITY RATE = F (DAY LENGTH, MAX TEMP, MIN TEMP)

NASA-S-78-16805

TECHNICAL IMPLEMENTATION



NASA-S-78-16809

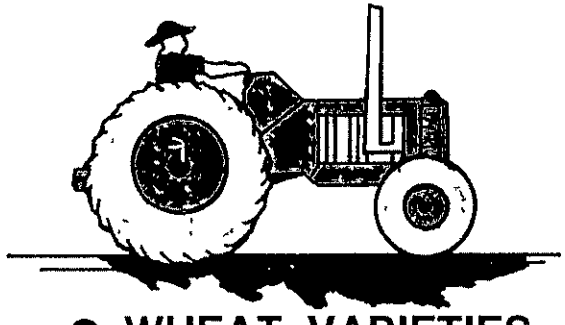
YIELD - MAJOR FACTORS

SOIL

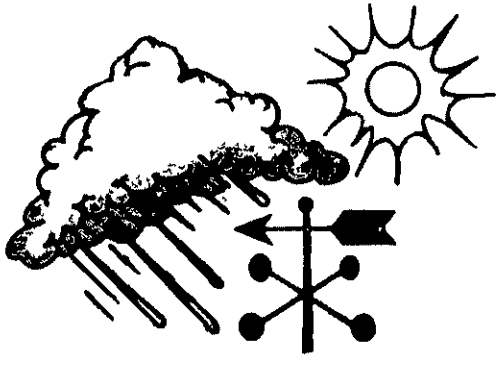


DIFFERS BY REGION AND COUNTRY

TECHNOLOGY



- WHEAT VARIETIES
- IRRIGATION
- CROPPING PRACTICE
- FERTILIZERS

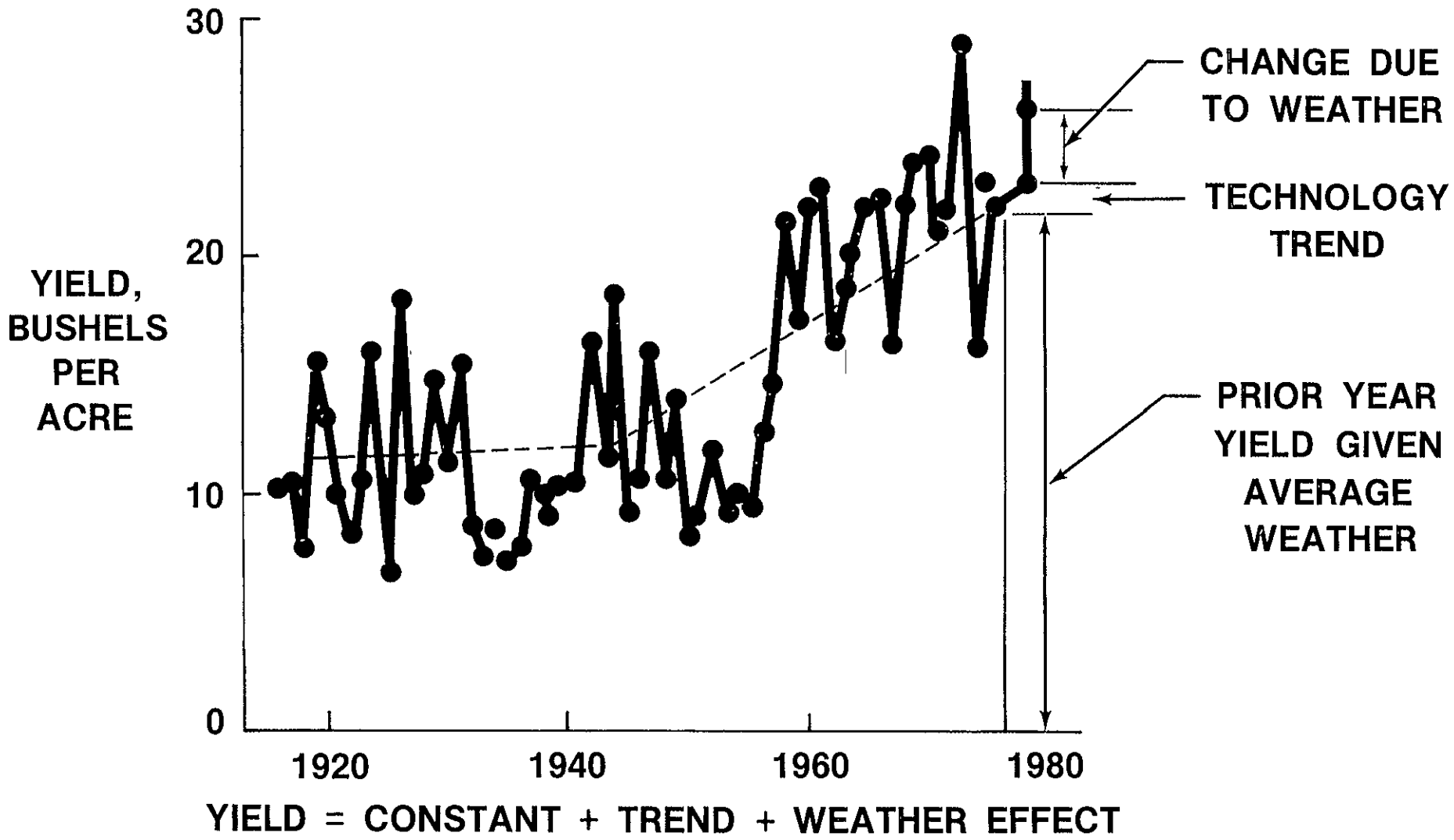


WEATHER

- SOIL MOISTURE, TEMPERATURE

NASA-S-78-16810

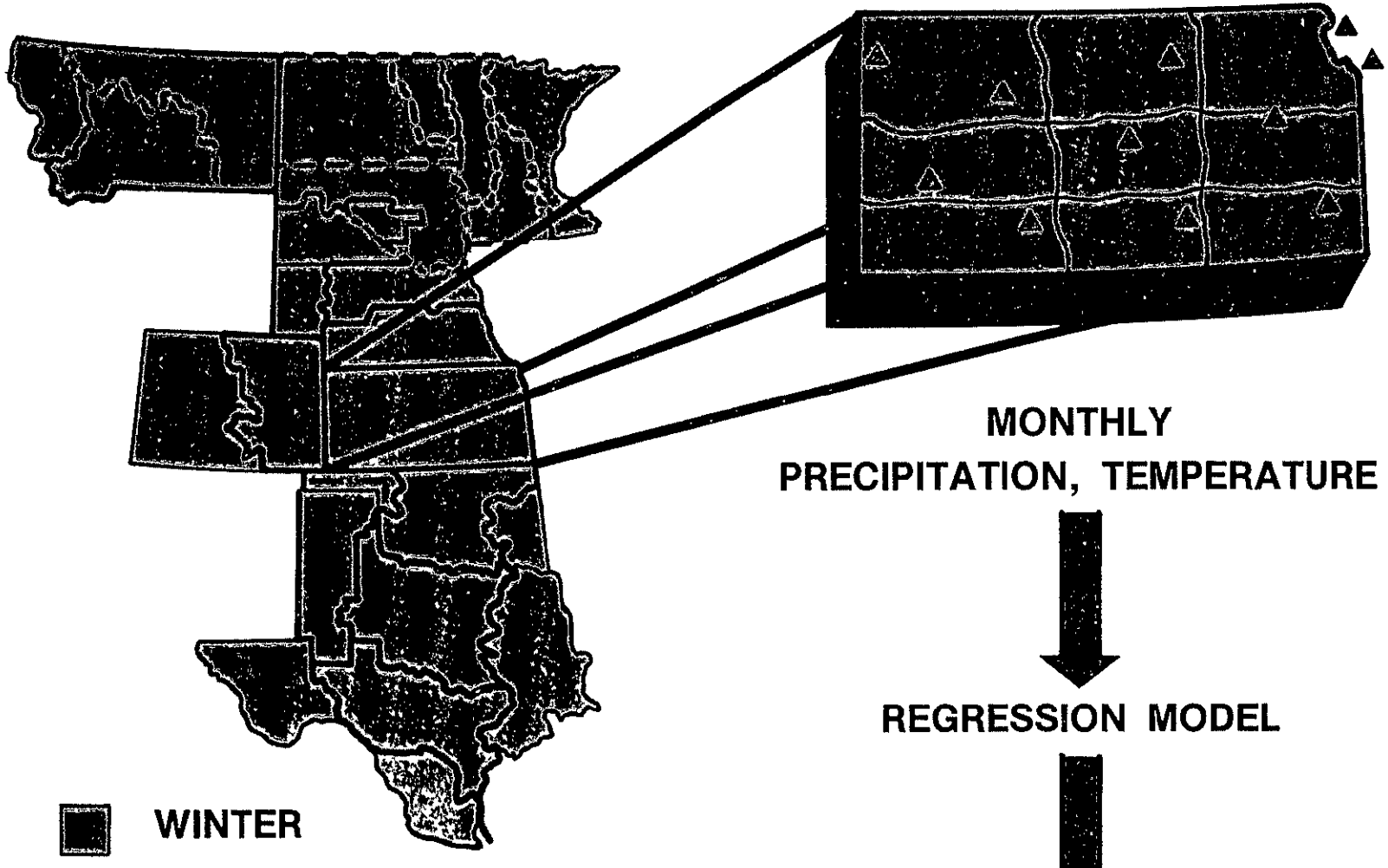
YIELD - REGRESSION MODEL



YIELD = CONSTANT + TREND + WEATHER EFFECT

NASA-S-78-16817

YIELD ESTIMATION



MONTHLY
PRECIPITATION, TEMPERATURE

↓

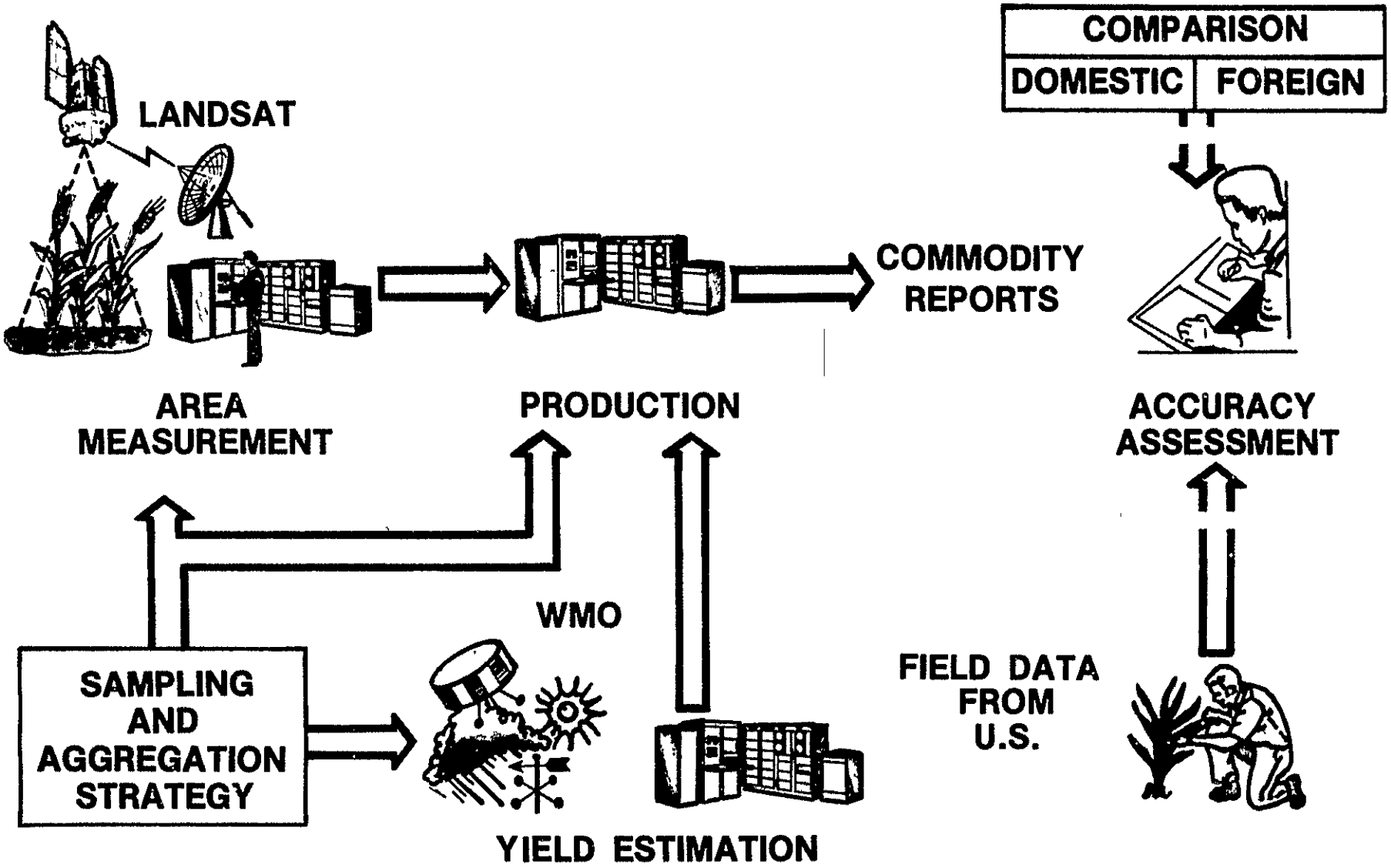
REGRESSION MODEL

↓

YIELD

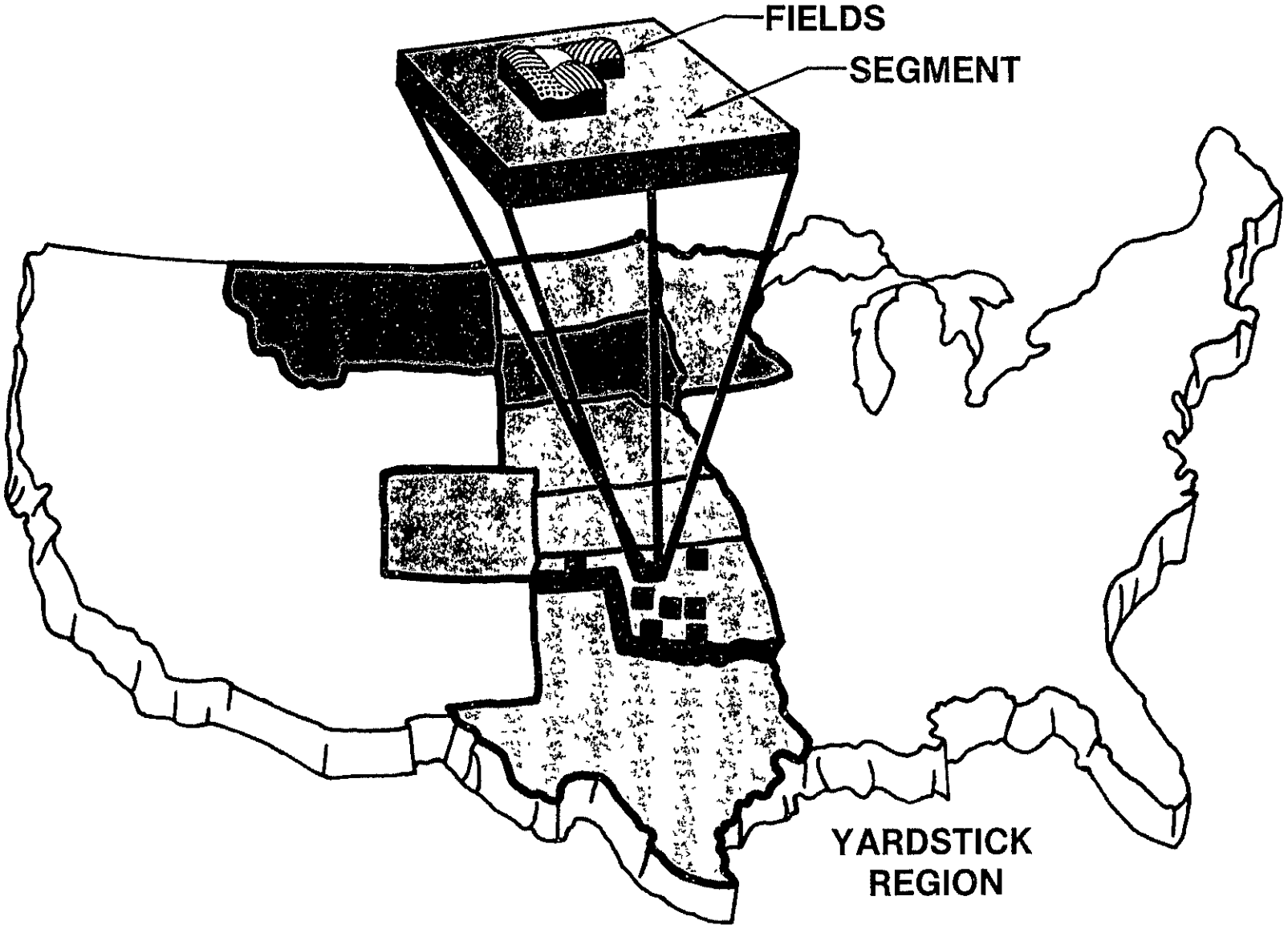
NASA-S-78-16803

TECHNICAL IMPLEMENTATION



Lyndon B Johnson Space Center
Houston Texas 77058

ACCURACY ASSESSMENT



RESULTS

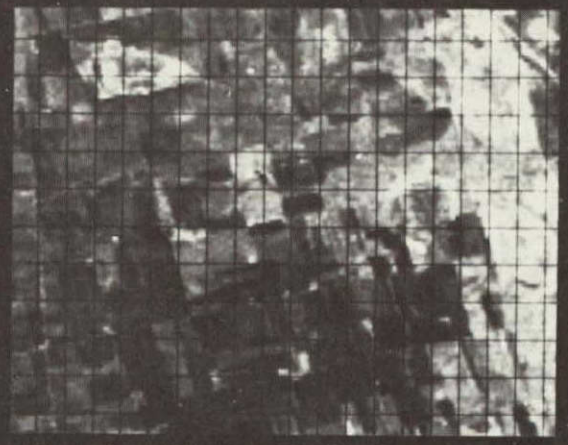
F Hall, JSC

PAGE 128 INTENTIONALLY BLANK

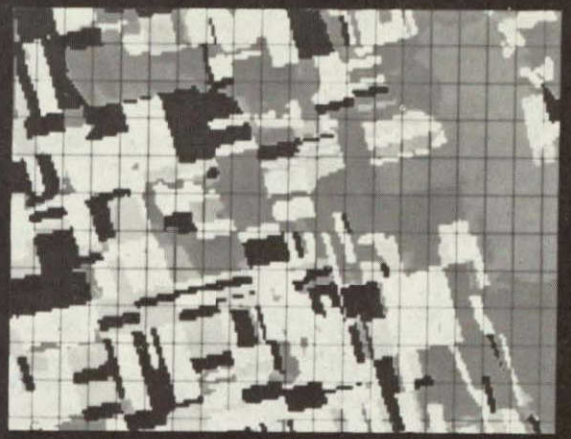
NASA-S-78-16068

LACIE RESULTS

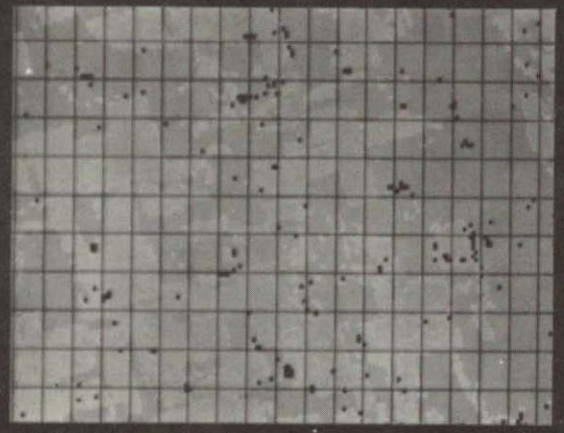
- REVIEW EXPERIMENT OBJECTIVES
- REVIEW LACIE STUDY AREAS
- RESULTS - ACCURACY AND PERFORMANCE
- ISSUES REQUIRING FURTHER ATTENTION



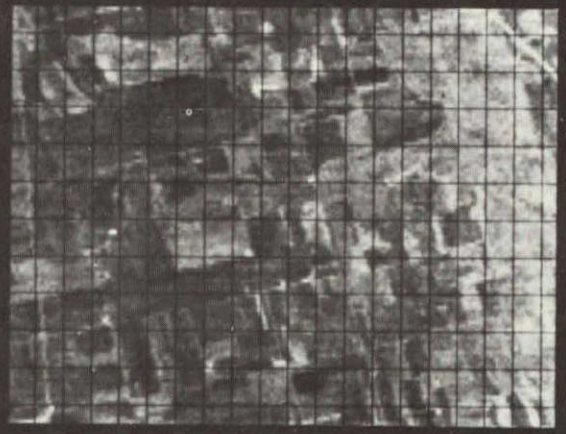
PLANTED, APRIL 30, 1977



AIRCRAFT AND GROUND INVENTORY DATE AUG 1, 1977



MULTIDATE MACHINE CLASSIFICATION GREEN — SMALL GRAINS



16 TO 30 IN. WHEAT, JUNE 23, 1977

- U.S.S.R.
- U.S. YARDSTICK
- CANADA
- FOREIGN EXPLORATORY REGIONS

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NASA-S-78-16064

1975 | 1976 | 1977 | 1978

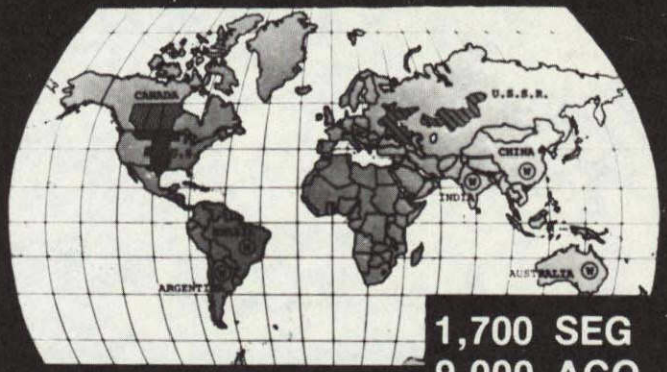
LACIE STUDY AREAS

PHASE I
- SYS DEVEL
- INITIAL EVAL U.S. YARDSTICK



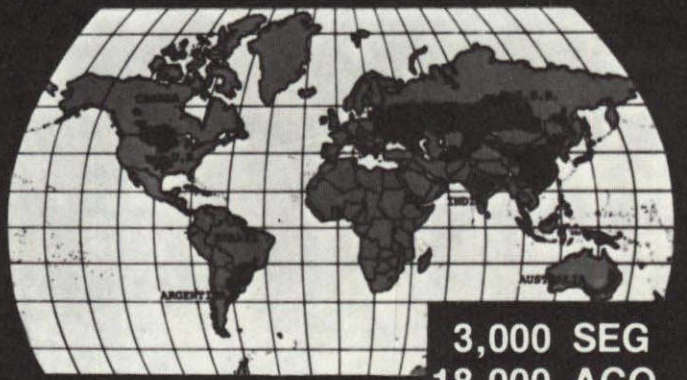
700 SEG
2,000 ACQ

PHASE II
- TECH MOD
- EXPANDED EVAL – U.S.S.R. INDICATOR REGIONS CANADA



1,700 SEG
9,000 ACQ

PHASE III
- NEW TECH
- TOTAL COUNTRY U.S.S.R. WHEAT
- CANADIAN GROUND-TRUTH TEST SITES



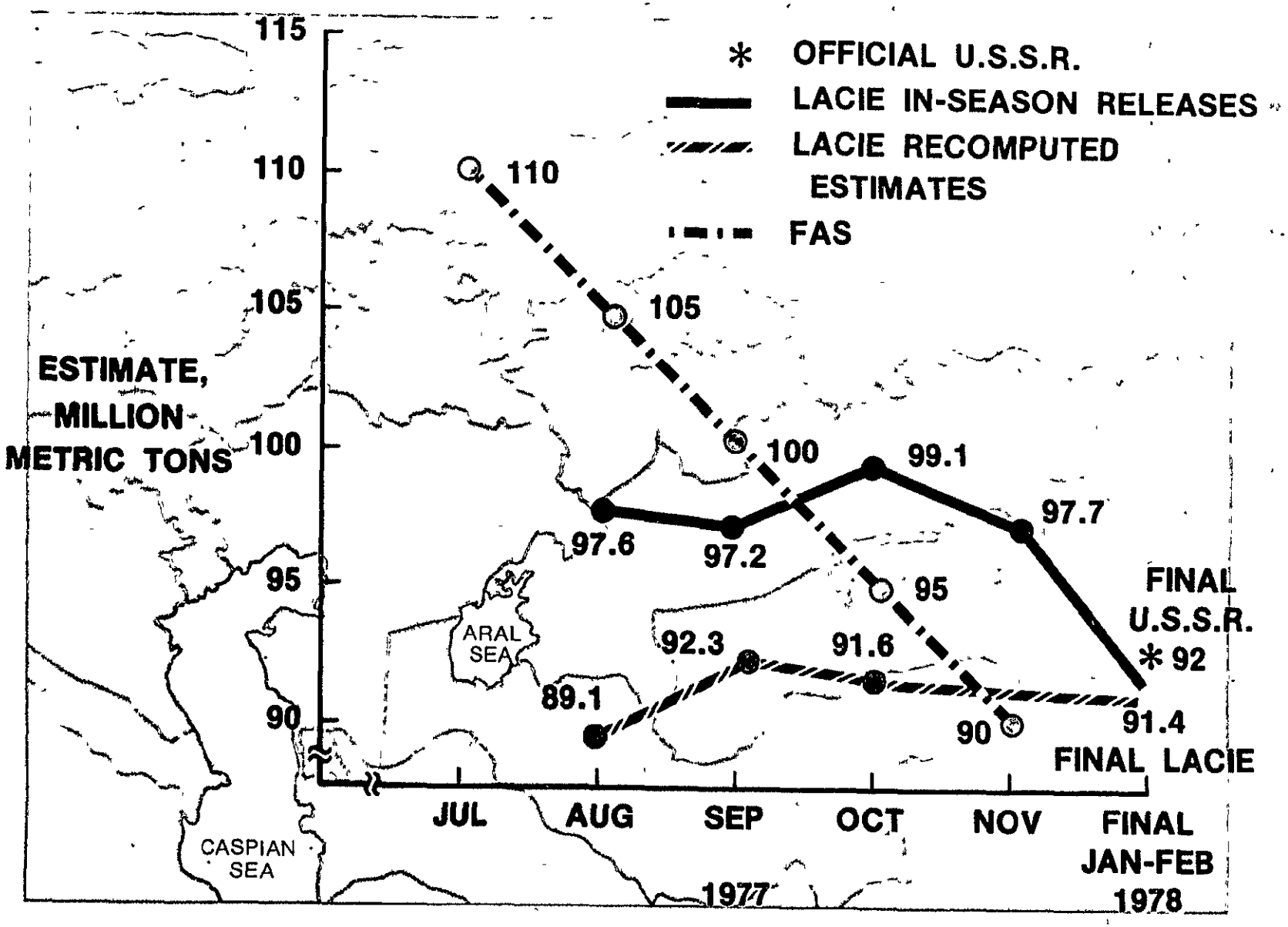
3,000 SEG
18,000 ACQ

AREAS OF LACIE ANALYSIS

Ⓦ WHEAT EXPLORATORY STUDY AREAS

NASA-S-78-16067

LACIE 1977 U.S.S.R. FORECASTS
TOTAL WHEAT



NASA-S-78-16410

LACIE 1977 U.S.S.R. WHEAT FORECASTS

- INITIAL LACIE WINTER WHEAT FORECASTS (MAY-JUNE) WERE FOR NEAR-RECORD SOVIET CROP
  - 22-PERCENT INCREASE IN SOVIET HECTARAGE FROM 1976
  - 11 PERCENT ABOVE AVERAGE YIELD FORECAST
- GIVEN AVERAGE SOVIET SPRING WHEAT CROP TOTAL WHEAT PRODUCTION WOULD BE NEAR RECORD
- INITIAL LACIE SPRING WHEAT FORECAST FOR DISASTROUS SPRING WHEAT CROP – 28 PERCENT SHORTFALL
  - 12.5 PERCENT BELOW AVERAGE YIELD
  - 9.0 PERCENT DECREASE IN HECTARAGE
- INITIAL LACIE FORECASTS OF WINTER AND SPRING WHEAT HECTARAGE, YIELD, AND PRODUCTION TURNED OUT TO BE VERY CLOSE TO U.S.S.R. OFFICIAL POSTHARVEST FIGURES

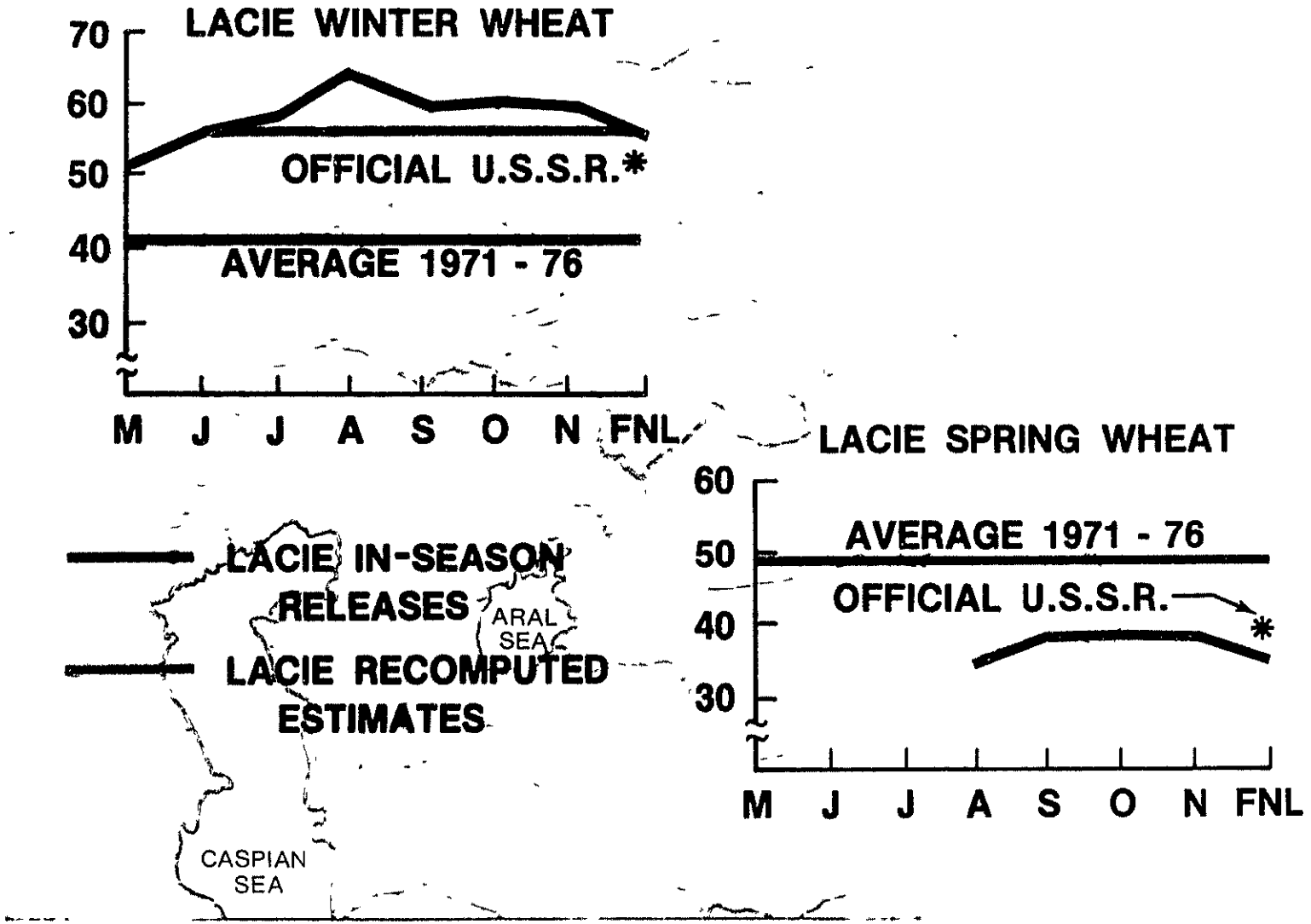
NASA-S-78-16411

LACIE 1977 U.S.S.R. WHEAT FORECASTS

- INITIAL 1977 LACIE AUGUST FORECAST FOR U.S.S.R. WHEAT
  - 11 PERCENT BELOW MOST RECENT FAS JULY FORECAST
  - 6 PERCENT ABOVE FINAL SOVIET FEBRUARY FIGURES
- FINAL LACIE U.S.S.R. WHEAT JANUARY ESTIMATE 1.0 PERCENT BELOW U.S.S.R. FIGURE
- RECOMPUTED LACIE ESTIMATES TO WITHIN 3 PERCENT OF U.S.S.R. FIGURE

NASA-S-78-16065

LACIE 1977 U.S.S.R. FORECASTS WINTER AND SPRING WHEAT



NASA-S-78-16407

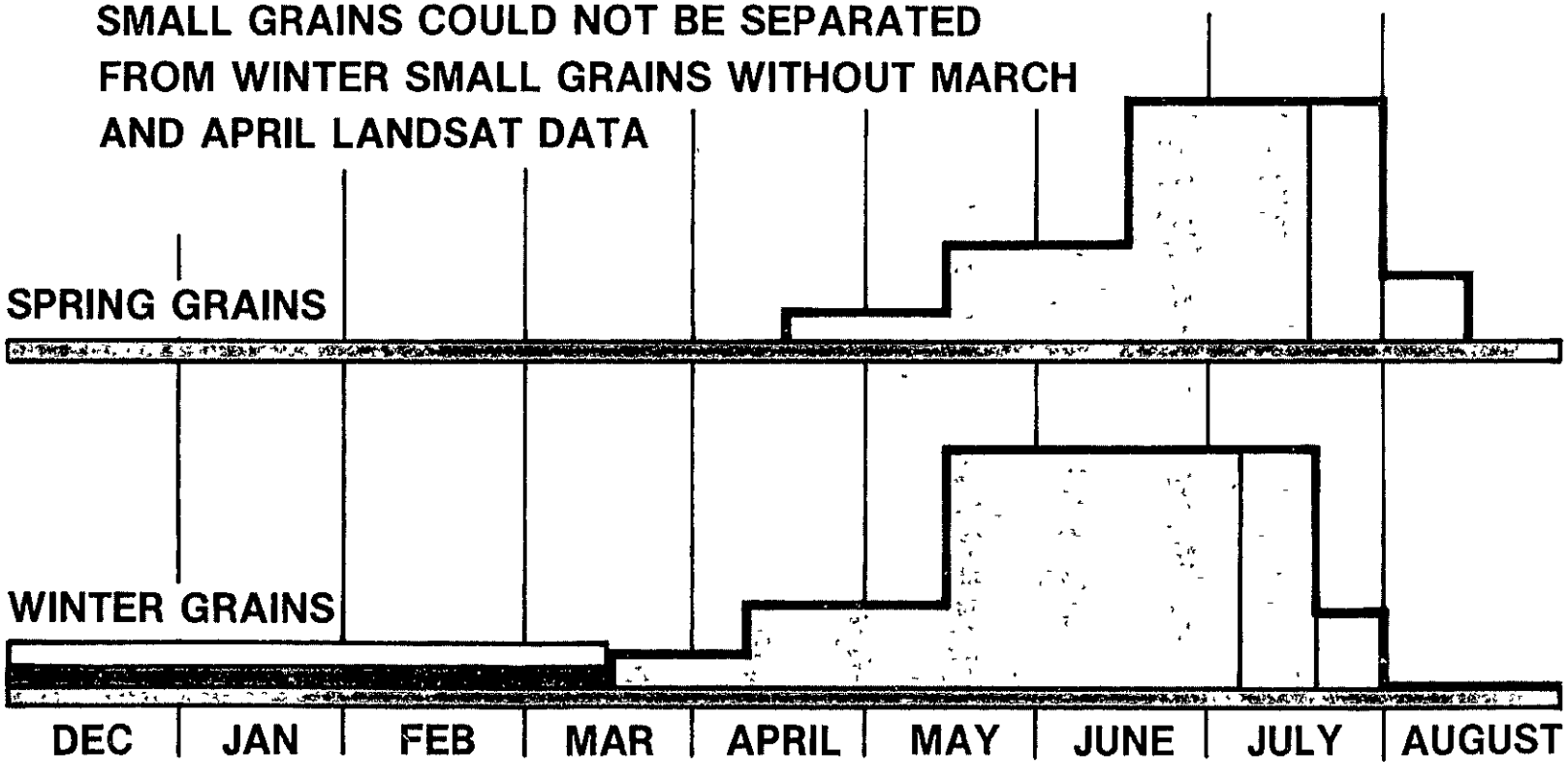
U.S.S.R. WHEAT AND TOTAL GRAINS PRODUCTION FOR THE YEARS 1971 THROUGH 1976

YEAR	WHEAT, MMT			GRAINS, MMT	RATIO WHEAT TO TOTAL GRAINS
	WINTER	SPRING	TOTAL		PERCENT
1971	47 787	50 973	98 790	181 175	54.5
1972	29 380	56 613	85 993	168 238	51.1
1973	49 435	60 349	109 784	222 530	49.3
1974	44 698	39 215	83 913	195 708	42.9
1975	36 651	29 573	66 224	140 118	47.2
1976	44 594	52 288	96 882	223 755	43.3
AVG	42 091	48 166	90 264	188 587	47.9

NASA S 78-16419

LACIE 1977 U.S.S.R. WHEAT RECOMPUTED ESTIMATES

- FOR 20 PERCENT OF THE U.S.S.R. WINTER WHEAT SEGMENTS CONTAINING SIGNIFICANT AMOUNTS OF SPRING SMALL GRAINS HECTARAGE, SPRING SMALL GRAINS COULD NOT BE SEPARATED FROM WINTER SMALL GRAINS WITHOUT MARCH AND APRIL LANDSAT DATA



NASA-S-78-16412

LACIE 1977 U.S.S.R. WHEAT RECOMPUTED ESTIMATES

- RECOMPUTED ESTIMATES FOR TOTAL WHEAT DECREASED BY ABOUT 7 PERCENT FROM IN-SEASON FORECASTS
- NO SIGNIFICANT EFFECT ON SPRING WHEAT PRODUCTION FORECASTS

NASA-S-78-16415

LACIE 1977 U.S.S.R. SPRING WHEAT FORECASTS

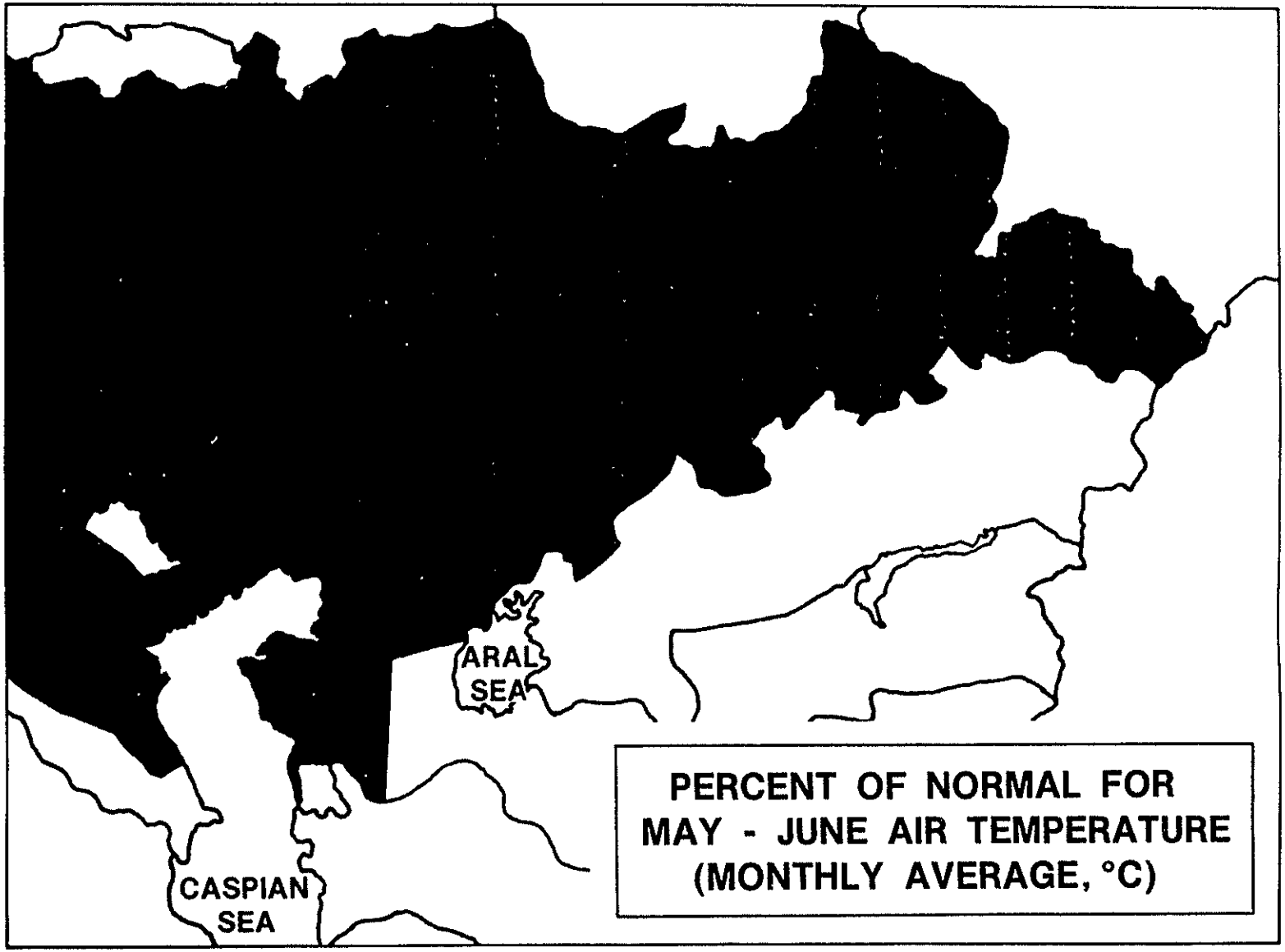
- 1977 U.S.S.R. CONDITIONS UNFAVORABLE FOR SPRING WHEAT
  - MAY AND JUNE MONTHLY TEMPERATURES ABOVE AVERAGE
  - MAY AND JUNE MONTHLY PRECIPITATION BELOW AVERAGE
  - COMBINATION LED TO BELOW-AVERAGE SUPPLY OF MOISTURE

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Lyndon B Johnson Space Center
Houston Texas 77058

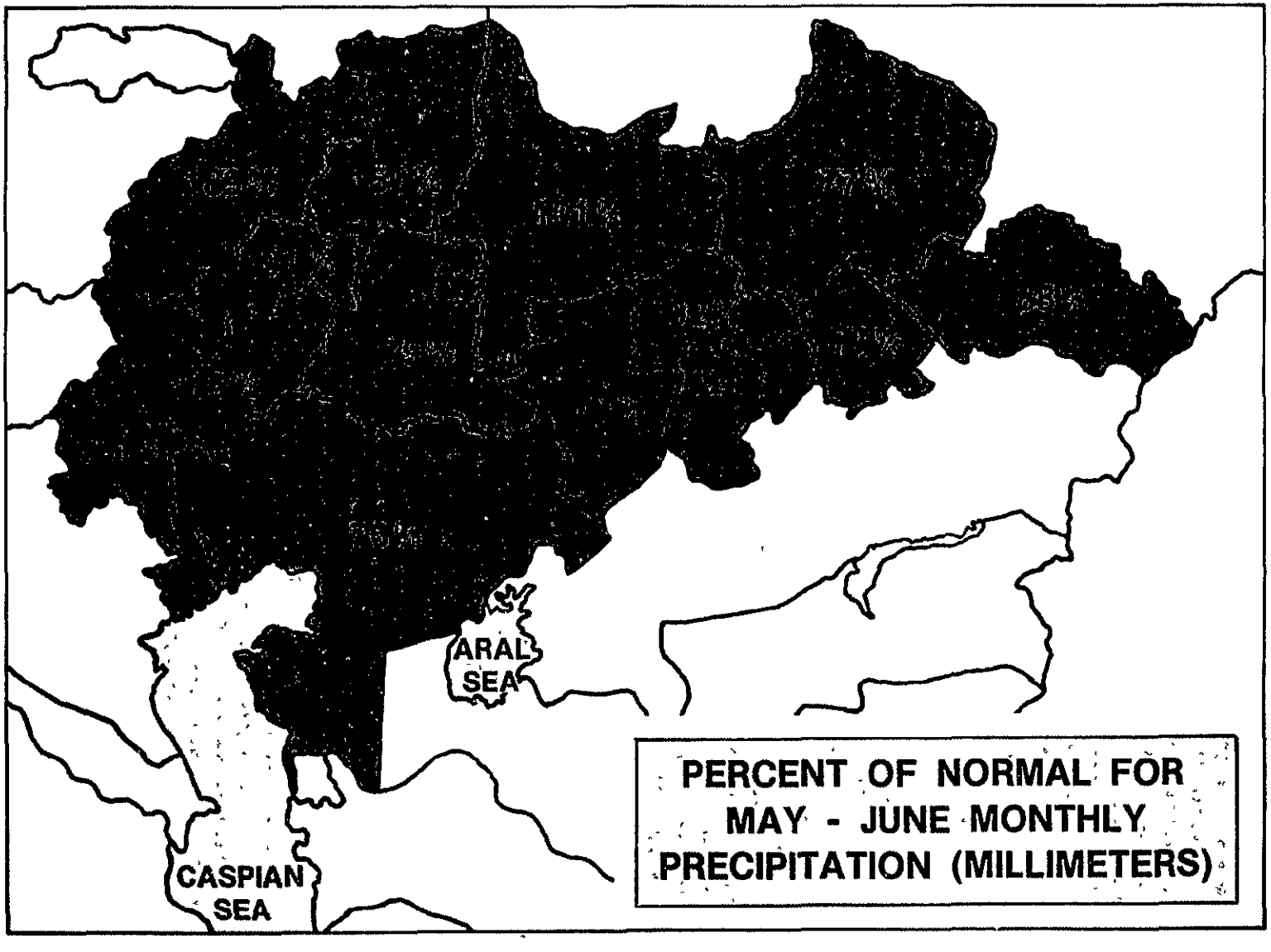
NASA-S-78 16424

U.S.S.R. SPRING WHEAT REGION



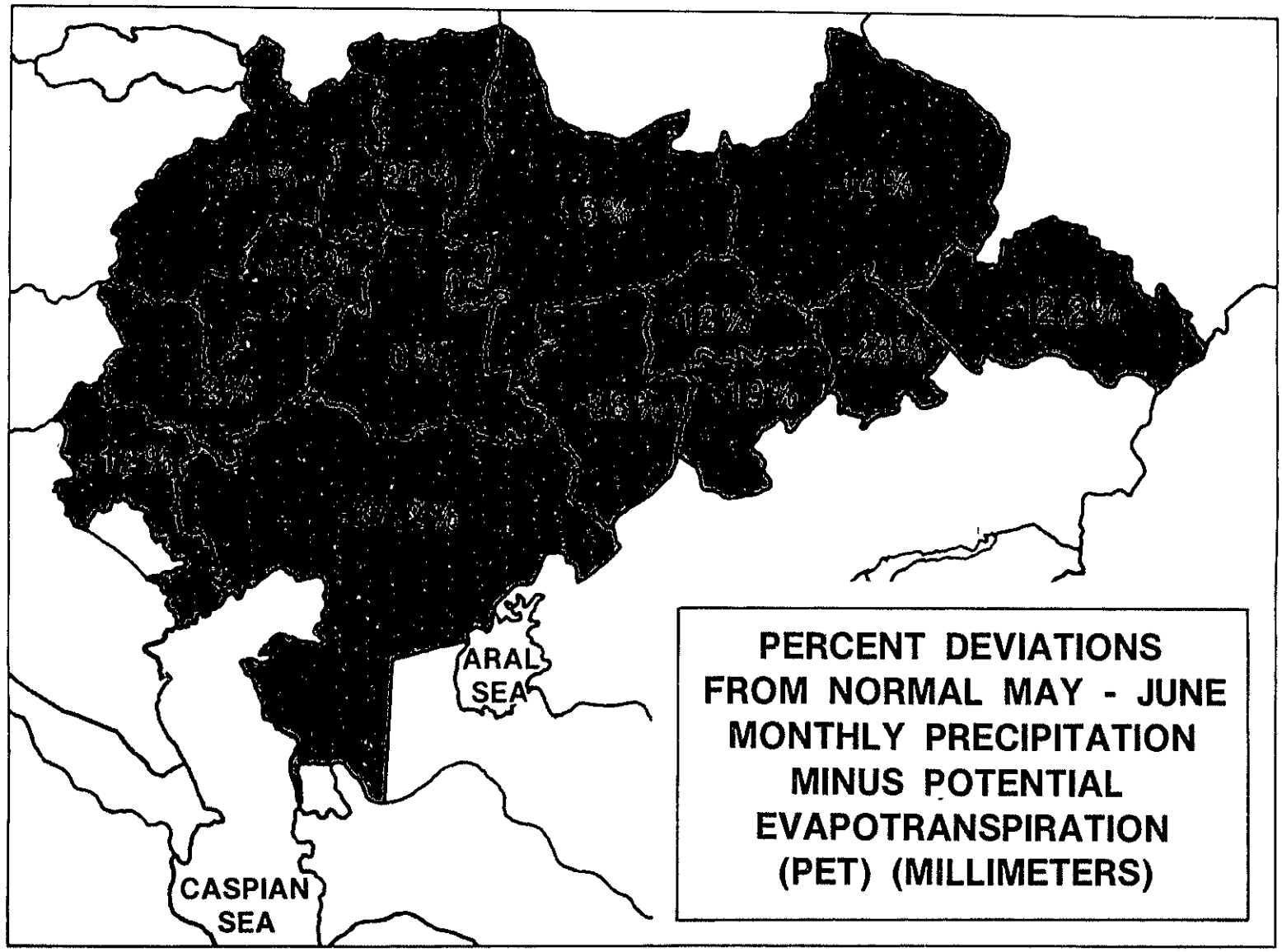
NASA-S-78-16421

U.S.S.R. SPRING WHEAT REGION



NASA S 78 16422

U.S.S.R. SPRING WHEAT REGION



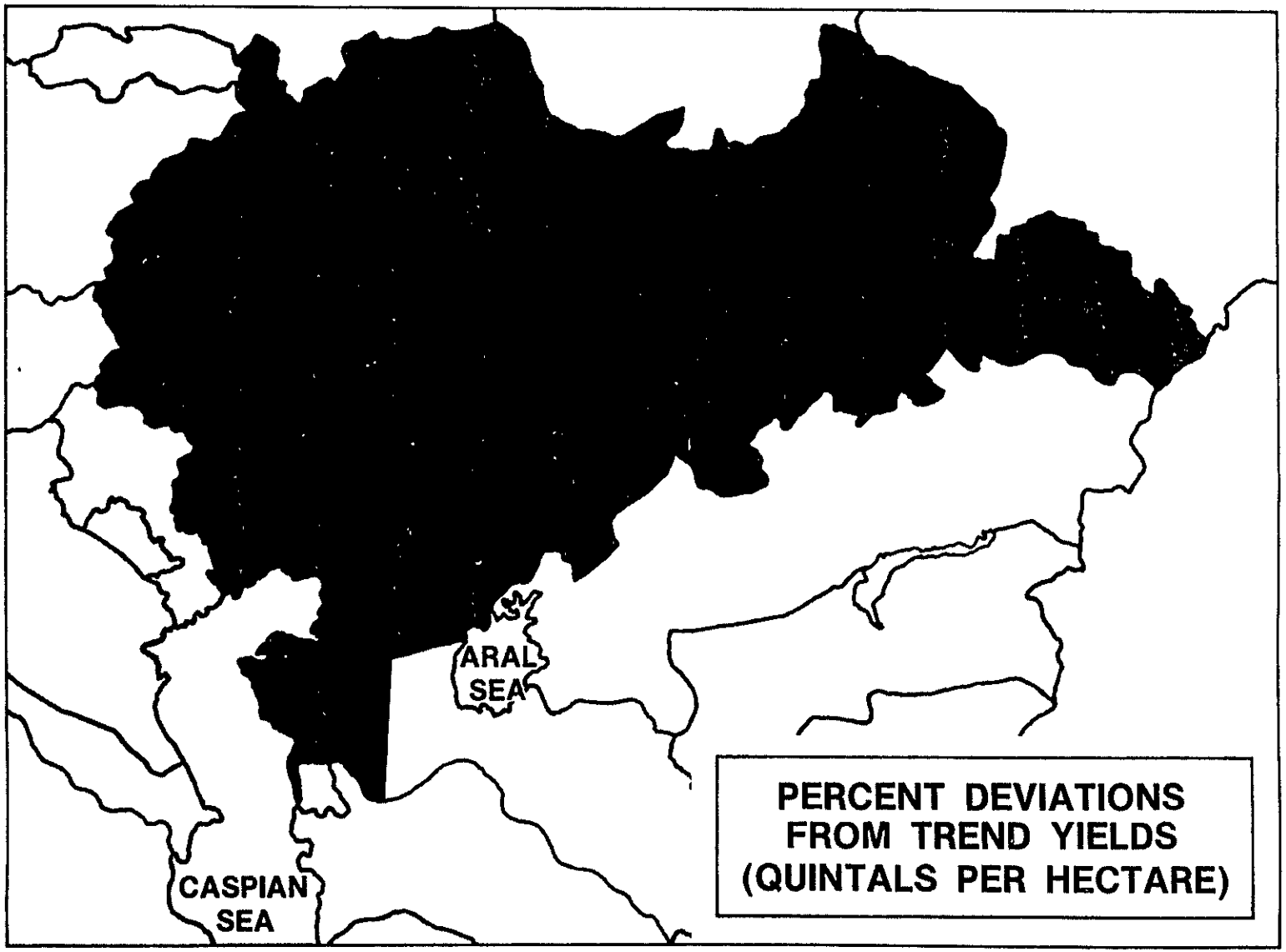
NASA-S-78-16413

LACIE 1977 U.S.S.R. SPRING WHEAT FORECASTS

- LACIE YIELD MODELS FORECAST SIGNIFICANT YIELD REDUCTIONS IN THE DROUGHT-AFFECTED REGIONS
- YIELD MODEL FORECASTS WERE CORROBORATED BY DROUGHT EFFECTS SEEN IN LANDSAT DATA
- LACIE FORECASTS WERE FOR ABOVE-AVERAGE CROP IN UNAFFECTED NORTHERN REGIONS
- ESTIMATED TOTAL WHEAT HECTARAGE IN EACH CROP REGION MUST BE COMBINED WITH YIELD FORECAST TO ASSESS TOTAL IMPACT ON PRODUCTION

NASA-S-78-16423

U.S.S.R. SPRING WHEAT REGION

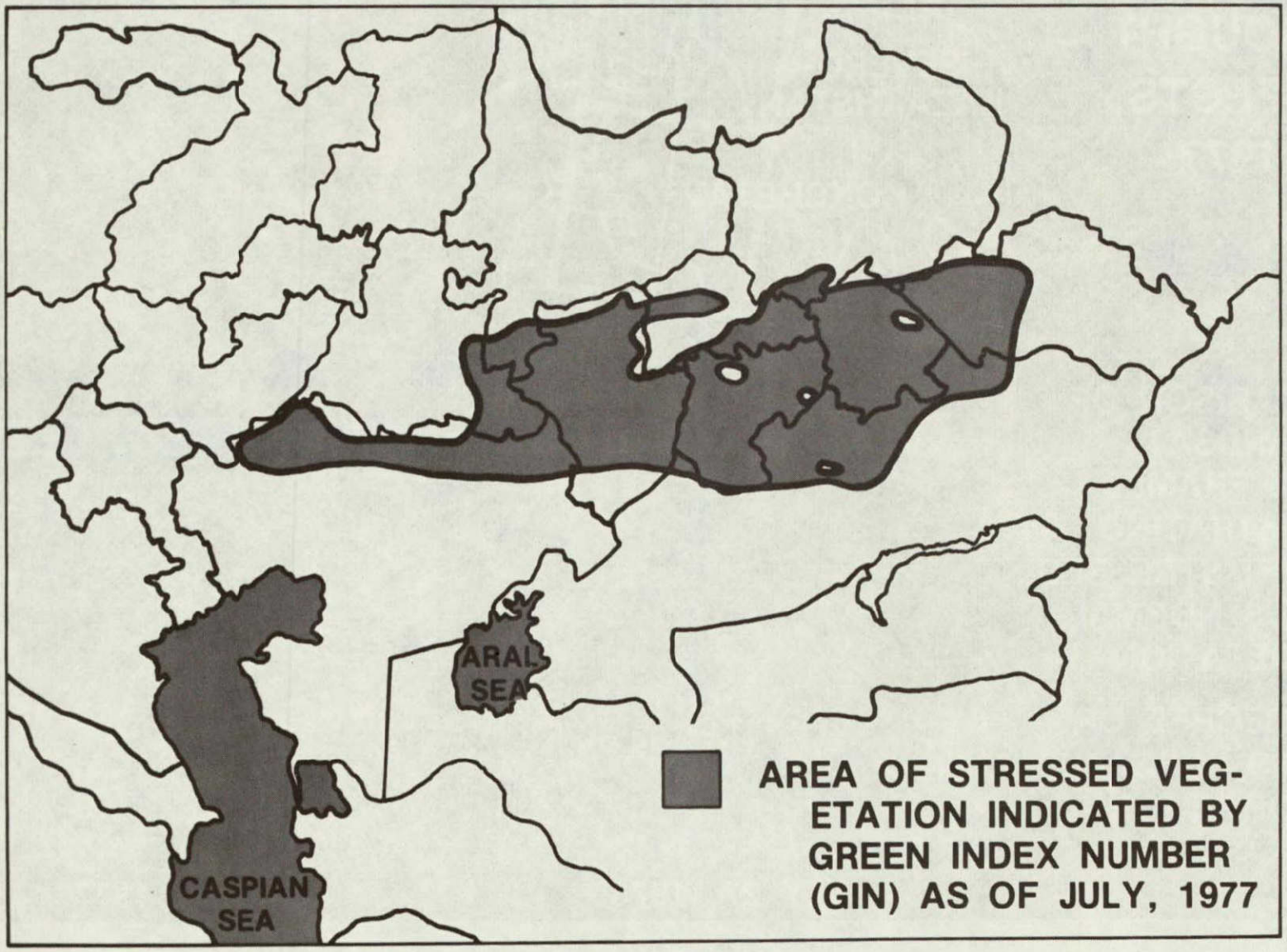


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Houston, Texas 77058

NASA-S-78-16400

U.S.S.R. STRESSED VEGETATION



NASA-S-78-16428

U.S.S.R. DROUGHT EFFECTS, 1977





COMPARISON OF LANDSAT FULL FRAMES ILLUSTRATING DROUGHT STRESSED VERSUS NORMAL VEGETATION

THE DEGREE OF REDNESS INDICATES CROP VIGOR



JULY 27, 1976



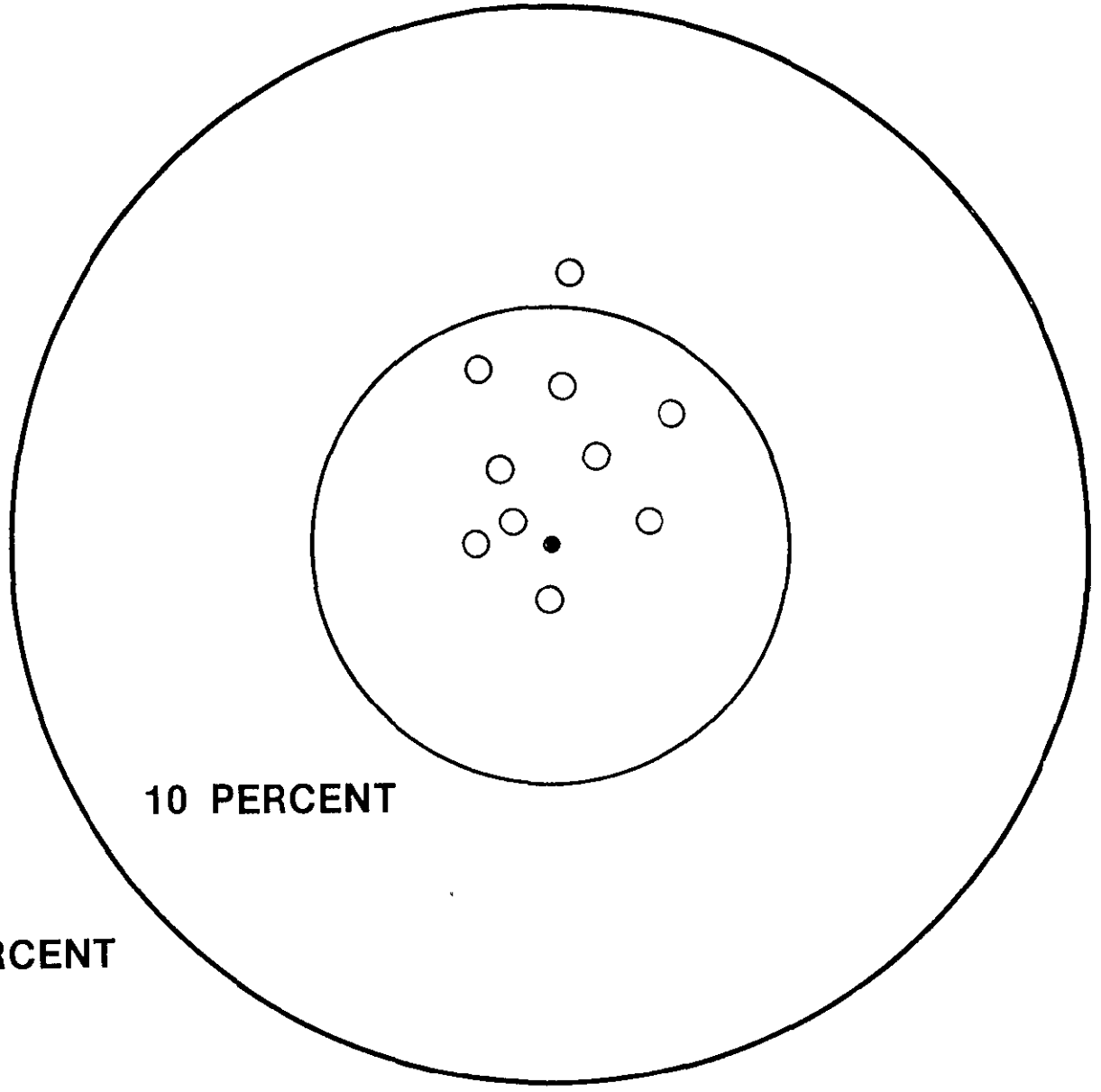
JULY 4, 1977

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OF POOR QUALITY

NASA-S-78-16116

90/90 CRITERION - TO BE WITHIN ±10 PERCENT OF TRUE

9 YEARS OF 10



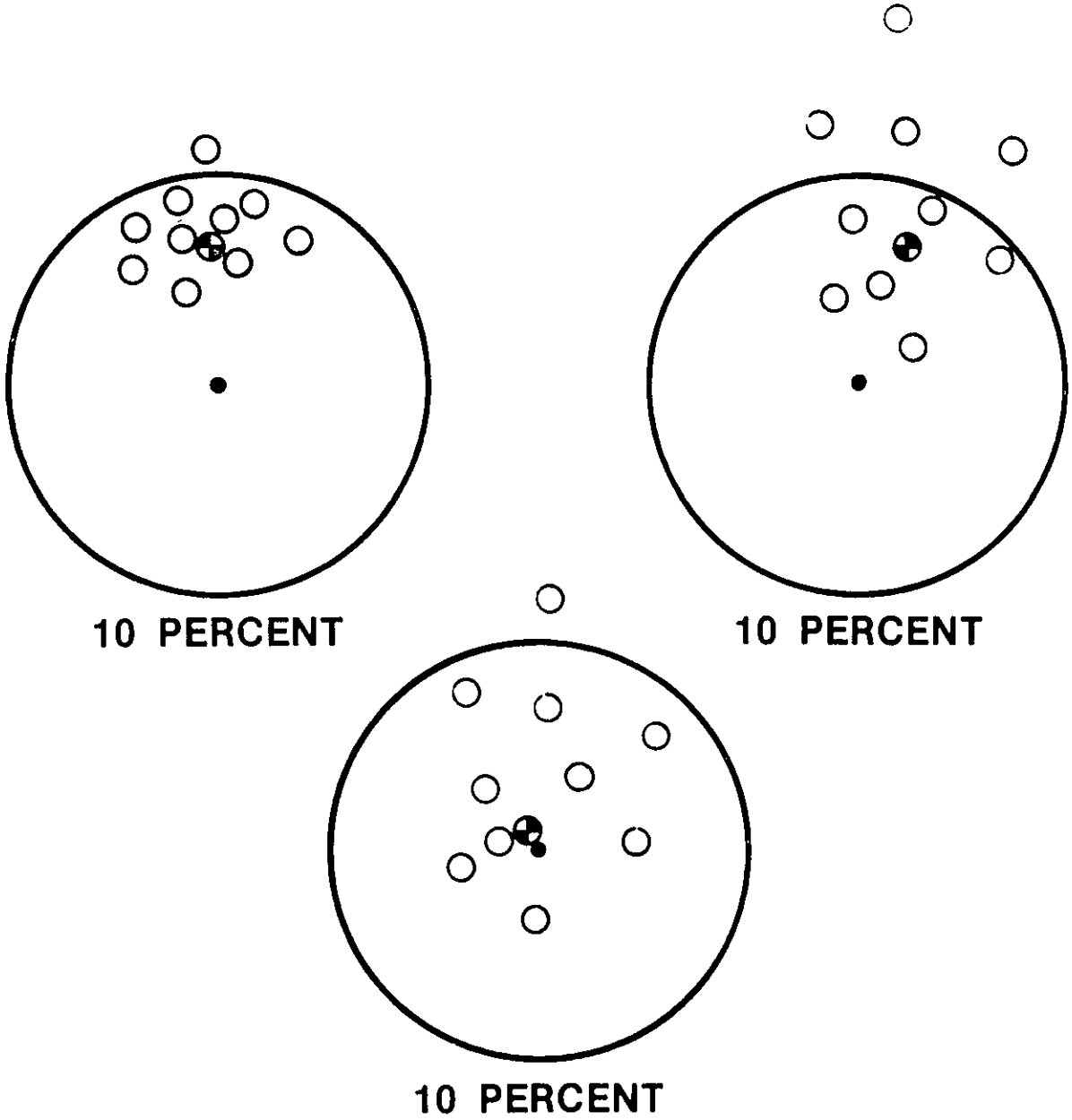
NASA-S-78-16108

LACIE ACCURACY PARAMETERS

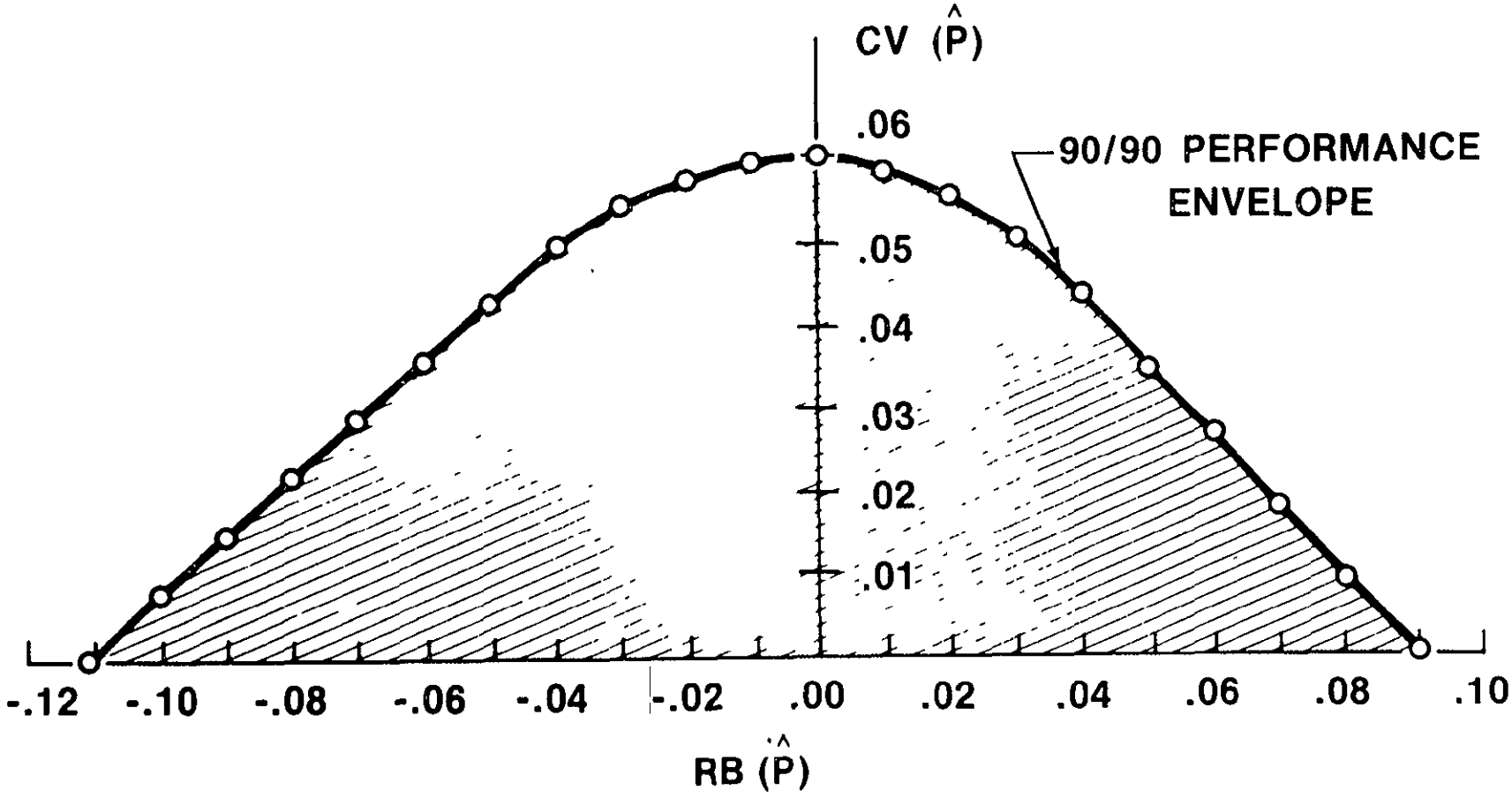
- RELATIVE BIAS = AVERAGE DEVIATION FROM TRUE, PERCENT
- RELATIVE DIFFERENCE = OBSERVED DEVIATION FROM TRUE, PERCENT – 1 YEAR
- COEFFICIENT OF VARIATION = CHARACTERISTIC WIDTH OF SCATTER, PERCENT

NASA S 78 16124

BIAS AND COEFFICIENT OF VARIATION



VALUES OF RELATIVE BIAS (RB) AND COEFFICIENT OF VARIATION (CV) THAT SUPPORT 90/90



NASA-S-78-16402

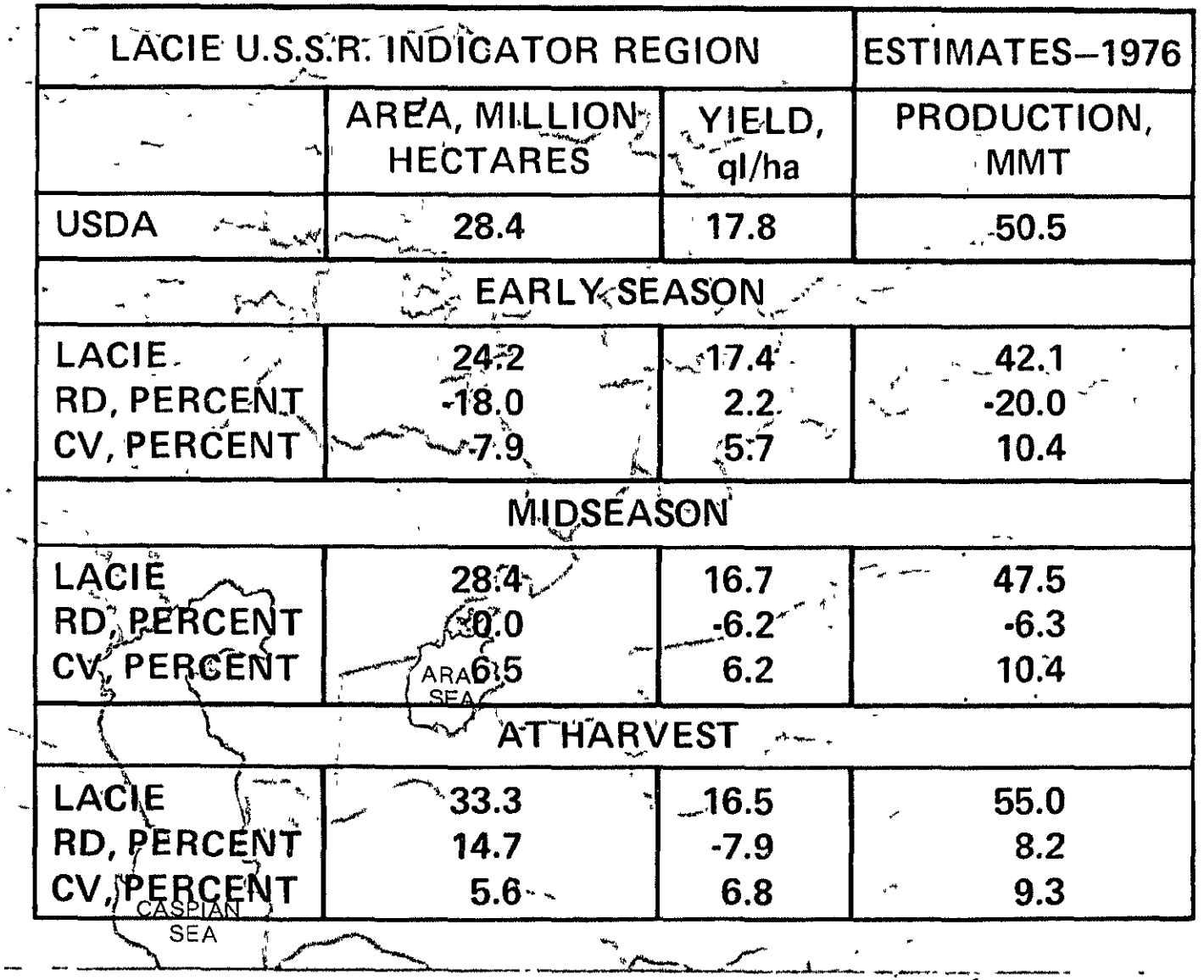
U.S.S.R. TOTAL WHEAT - 1977

	AREA, MILLION HECTARES	YIELD, ql/ha	PRODUCTION, MMT
FINAL (FEB 1978)			
U.S.S.R.	62.0	14.8	92.0
AUGUST			
LACIE	61.0	14.9	90.9
RD, PERCENT	-1.6	0.7	-1.2
CV, PERCENT	∿2.6	—	∿4.3
SEPTEMBER			
LACIE	62.6	14.9	93.1
RD, PERCENT	1.0	0.0	1.2
CV, PERCENT	1.9	—	3.9
OCTOBER			
LACIE	64.2	14.6	93.5
RD, PERCENT	3.4	-2.1	1.6
CV, PERCENT	1.8	—	3.8
FINAL			
LACIE	62.9	14.5	91.4
RD, PERCENT	1.4	-2.1	-0.6
CV, PERCENT	1.8	—	3.8

NASA-S-78-16429

LACIE PHASE II RESULTS
U.S.S.R. INDICATOR REGIONS

LACIE U.S.S.R. INDICATOR REGION			ESTIMATES–1976
	AREA, MILLION HECTARES	YIELD, ql/ha	PRODUCTION, MMT
USDA	28.4	17.8	50.5
EARLY SEASON			
LACIE	24.2	17.4	42.1
RD, PERCENT	-18.0	2.2	-20.0
CV, PERCENT	7.9	5.7	10.4
MIDSEASON			
LACIE	28.4	16.7	47.5
RD, PERCENT	0.0	-6.2	-6.3
CV, PERCENT	6.5	6.2	10.4
AT HARVEST			
LACIE	33.3	16.5	55.0
RD, PERCENT	14.7	-7.9	8.2
CV, PERCENT	5.6	6.8	9.3



AT-HARVEST COMPARISON OF LACIE AND USDA 1976 CANADIAN WHEAT ESTIMATES

	AREA, MILLIONS OF ACRES	YIELD, BUSHELS/ACRE	PRODUCTION, MILLIONS OF BUSHELS
USDA	26.8	31.1	834
LACIE	20.8	27.7	576
RD, PERCENT	-29.0	-12.0	-57.0
CV, PERCENT	3.0	3.0	5.0

LACIE 1976 CANADIAN SPRING WHEAT FORECASTS

- 1976 LACIE PHASE II TESTS OF TECHNOLOGY FOR CANADIAN SPRING WHEAT INDICATED NEED TO IMPROVE TECHNOLOGY

- U.S. YARDSTICK HARD RED SPRING WHEAT TEST RESULTS WERE INDICATING PROBLEMS OF SIMILAR MAGNITUDE

AT-HARVEST COMPARISON OF LACIE AND USDA 1976 U.S. HARD RED SPRING WHEAT ESTIMATES

	AREA, MILLIONS OF ACRES	YIELD, BUSHELS/ACRE	PRODUCTION, MILLIONS OF BUSHELS
USDA	19.8	25.3	501.1
LACIE	15.6	26.3	409.9
RD, PERCENT	-26.9	3.8	-22.2

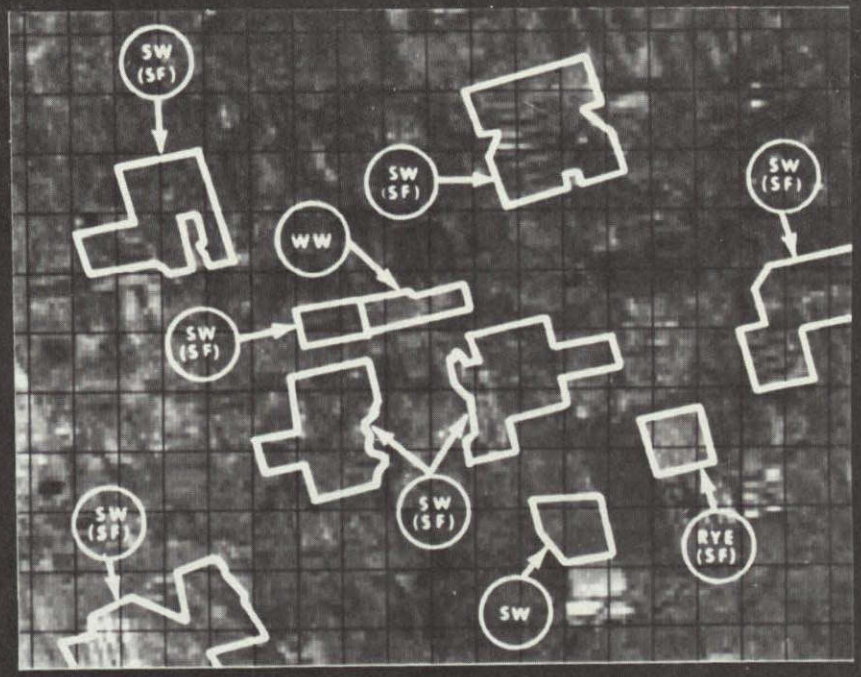
LACIE 1976 CANADIAN SPRING WHEAT FORECASTS

- EXTENSIVE INVESTIGATIONS IN U.S. YARDSTICK HARD RED SPRING WHEAT AREA PROVIDED INSIGHT INTO CANADIAN PROBLEMS
  - SMALL FIELDS/STRIP FALLOW
  - CONFUSION BETWEEN SPRING BARLEY, SPRING WHEAT
- NO SIGNIFICANT PROBLEMS IN U.S.S.R.
  - LARGER FIELDS
  - FEWER PROBLEMS WITH CONFUSION CROPS

NASA-S-78-16425

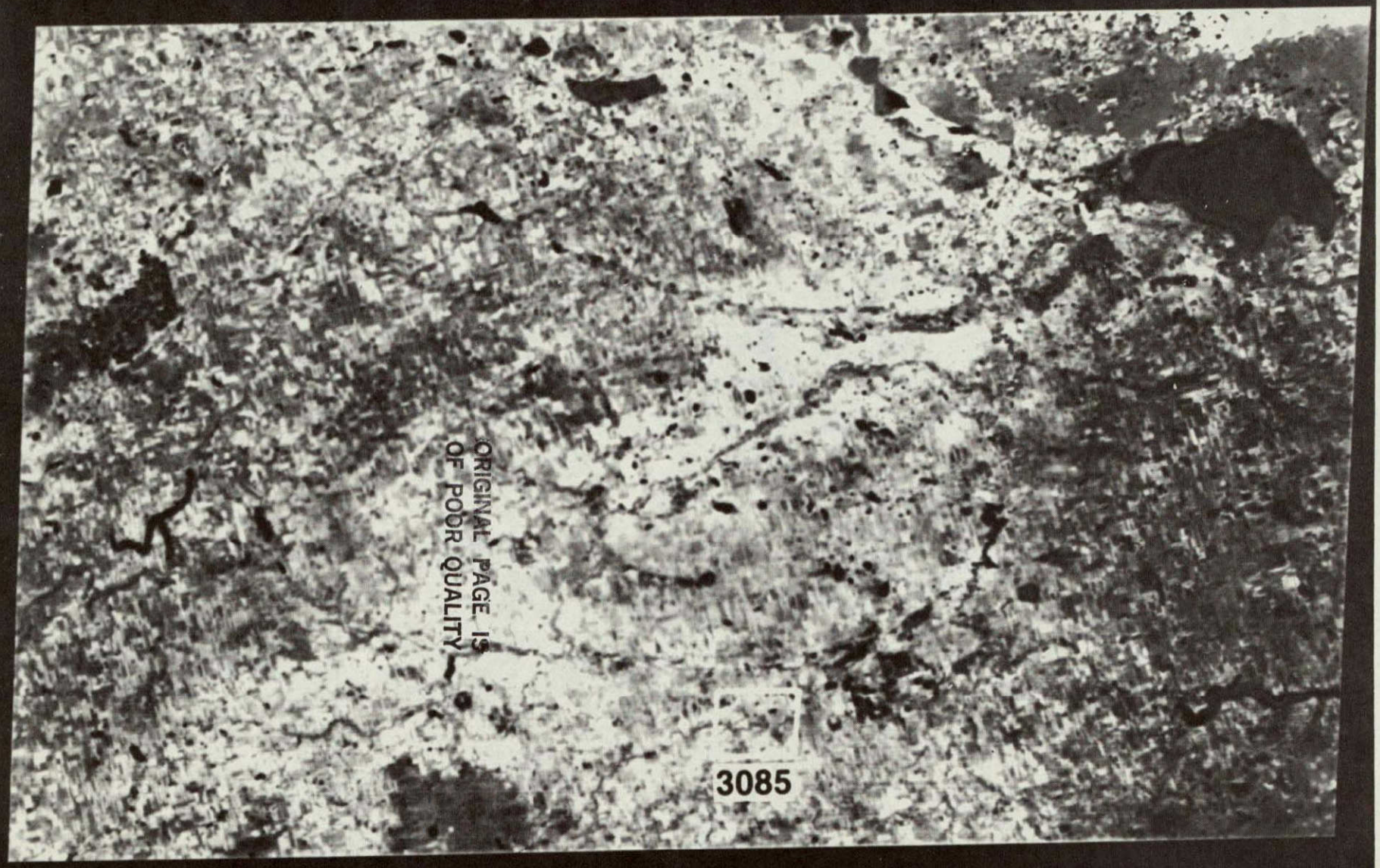
LANDSAT DATA ACQUIRED OVER U.S. STRIP-FALLOW REGION WITH SMALL FIELDS



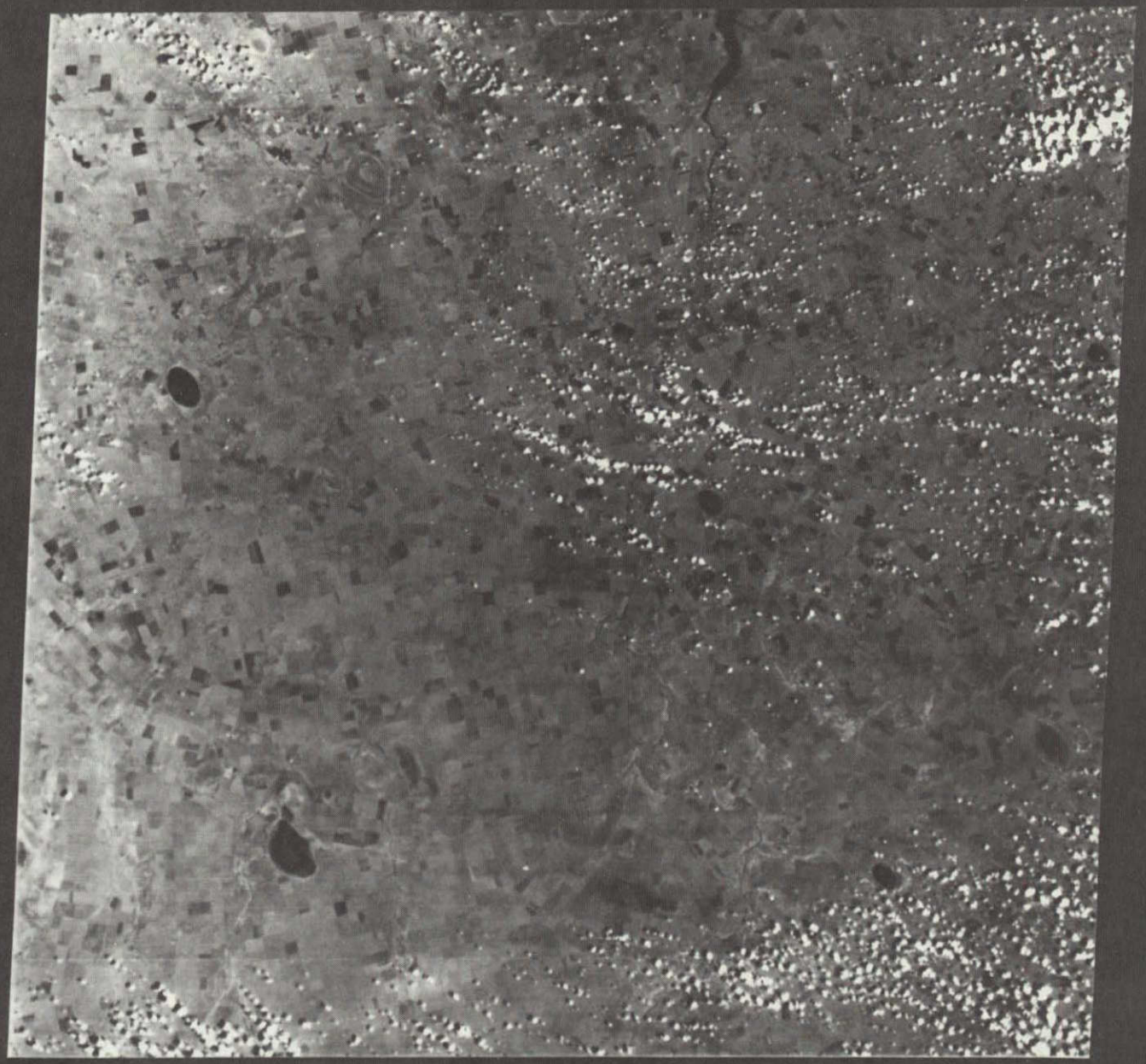


NASA-S-78-16427

CANADA WHEAT, SASKATCHEWAN



NASA-S-78-16426



KOKCHETAV, U.S.S.R.

NASA-S-78-16118

LACIE U.S. YARDSTICK RESULTS

- FINDINGS IN THE U.S. YARDSTICK REGION SUBSTANTIATED FINDINGS IN THE U.S.S.R. AND CANADA

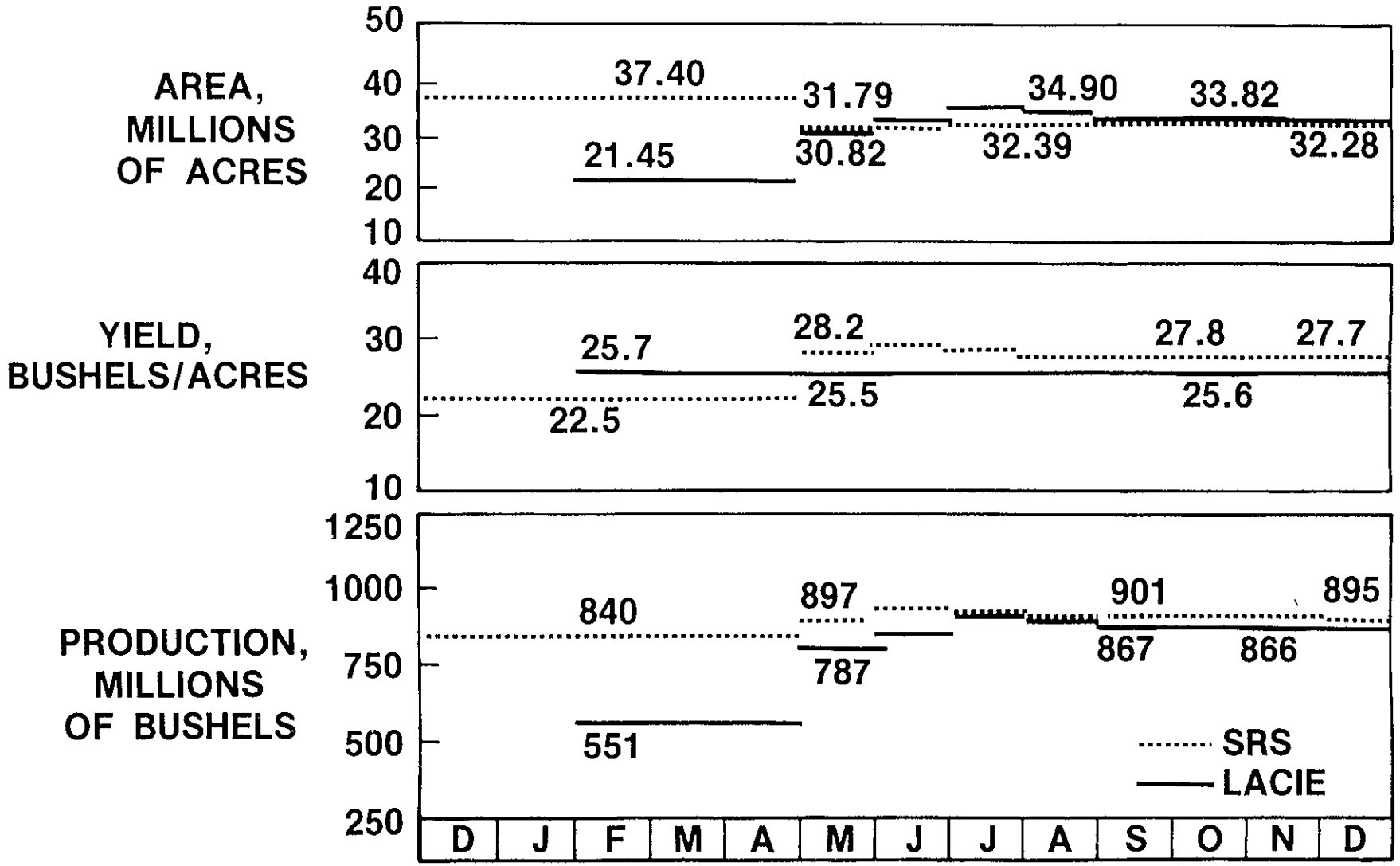
- THROUGH COMPARISON WITH GROUND-ACQUIRED DATA, AN UNDERSTANDING OF THE MAJOR AGRICULTURAL AND WEATHER FACTORS THAT AFFECT LACIE PERFORMANCE WAS GAINED

LACIE U.S. YARDSTICK RESULTS

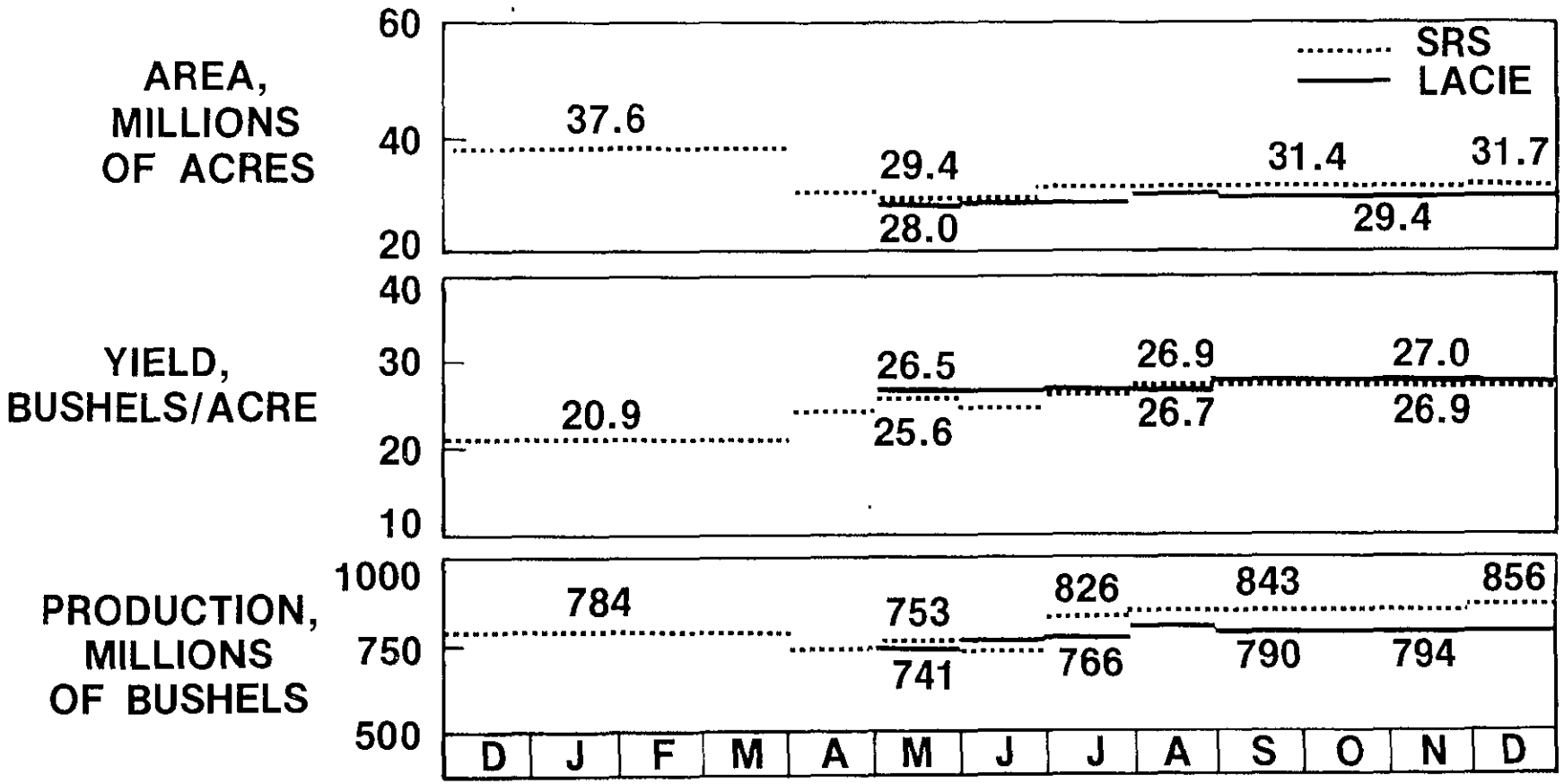
- U.S. WINTER WHEAT
  - THREE YEARS OF U.S. RESULTS INDICATE THAT LACIE ACCURACIES FOR U.S. HARD RED WINTER WHEAT SUPPORT USDA PERFORMANCE GOALS
    - ACCURACIES SUPPORT 90/90 AT-HARVEST GOAL
    - IN PHASES II AND III, ACCURACIES SUPPORT 1.5 MONTHS PREHARVEST
- U.S. SPRING WHEAT
  - PHASE III IMPROVEMENTS TO LANDSAT ANALYSIS PROCEDURES (PROCEDURE 1) SIGNIFICANTLY REDUCED PHASE II SPRING WHEAT ACREAGE UNDERESTIMATE

NASA S 78 16166

MONTHLY COMPARISON OF LACIE AND SRS ESTIMATES SEVEN-STATE WINTER WHEAT PHASE III



MONTHLY COMPARISON OF LACIE AND SRS ESTIMATES SEVEN-STATE WINTER WHEAT PHASE II



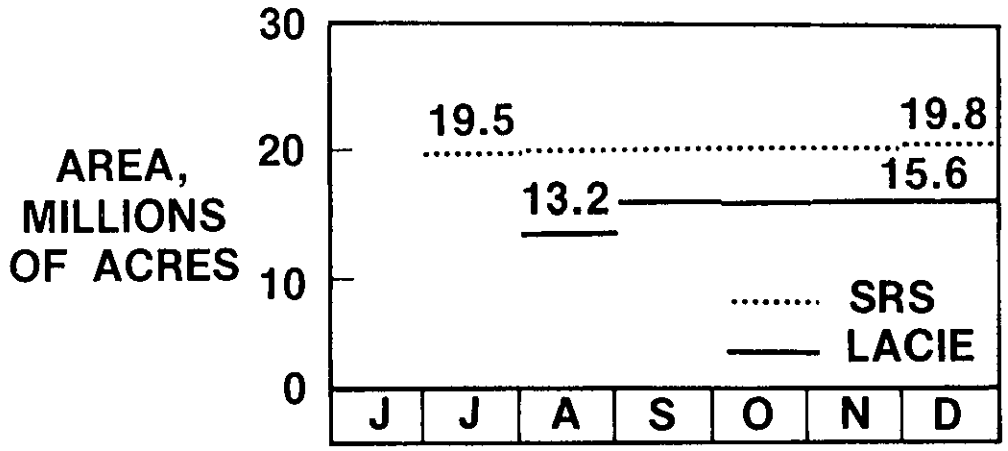
NASA S 78 16131

LACIE U.S. YARDSTICK RESULTS

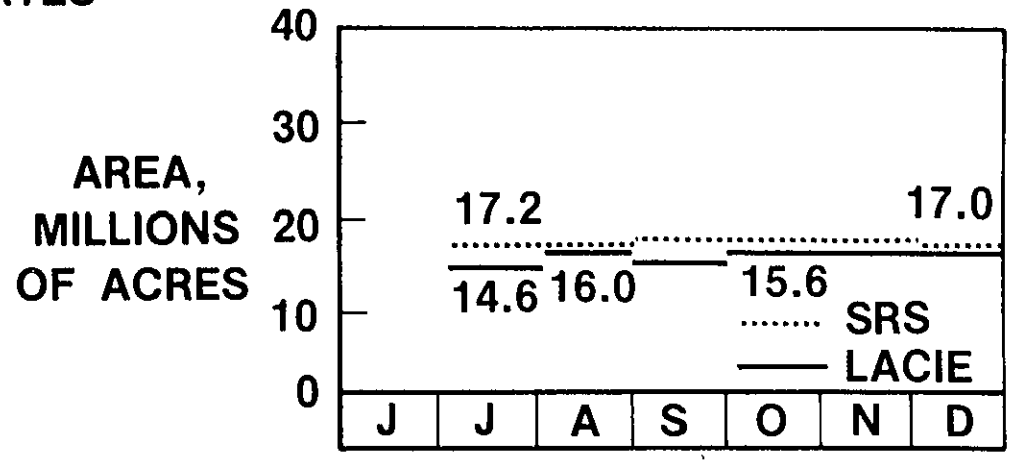
MONTHLY COMPARISON OF LACIE AND USDA ESTIMATES
PHASE II AND PHASE III

FOUR-STATE SPRING WHEAT

MINNESOTA
MONTANA
NORTH DAKOTA
SOUTH DAKOTA



LACIE PHASE II
AREA ESTIMATES

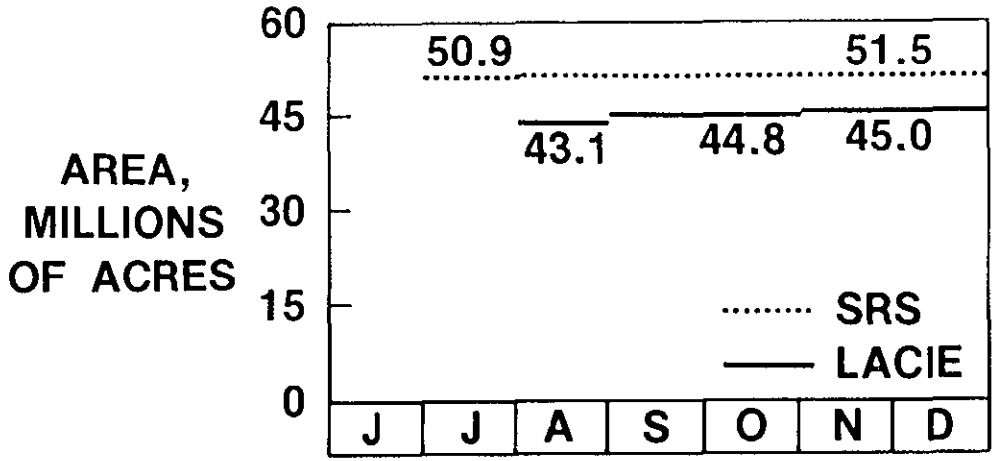


LACIE PHASE III
AREA ESTIMATES

NASA S 78 16130

LACIE U.S. YARDSTICK RESULTS

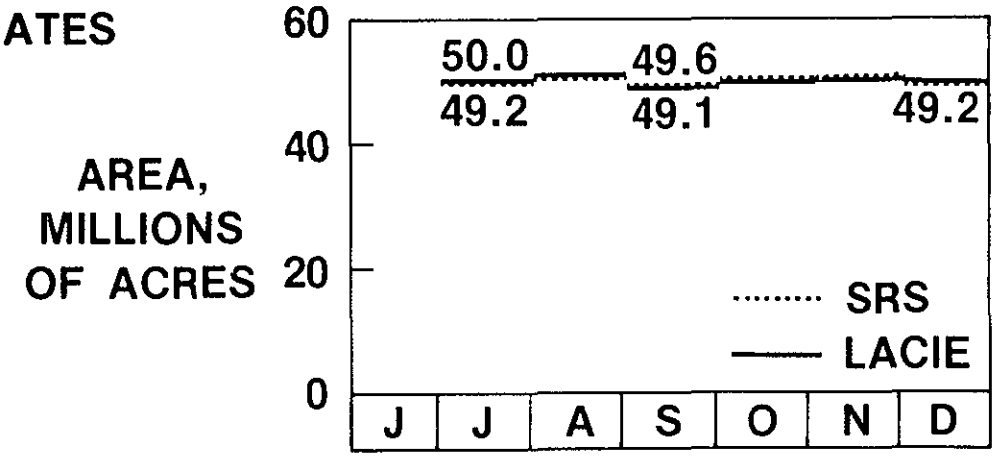
MONTHLY COMPARISONS OF LACIE AND USDA ESTIMATES OF U.S. YARDSTICK WHEAT AREA



LACIE PHASE II
AREA ESTIMATES

U.S. GREAT PLAINS

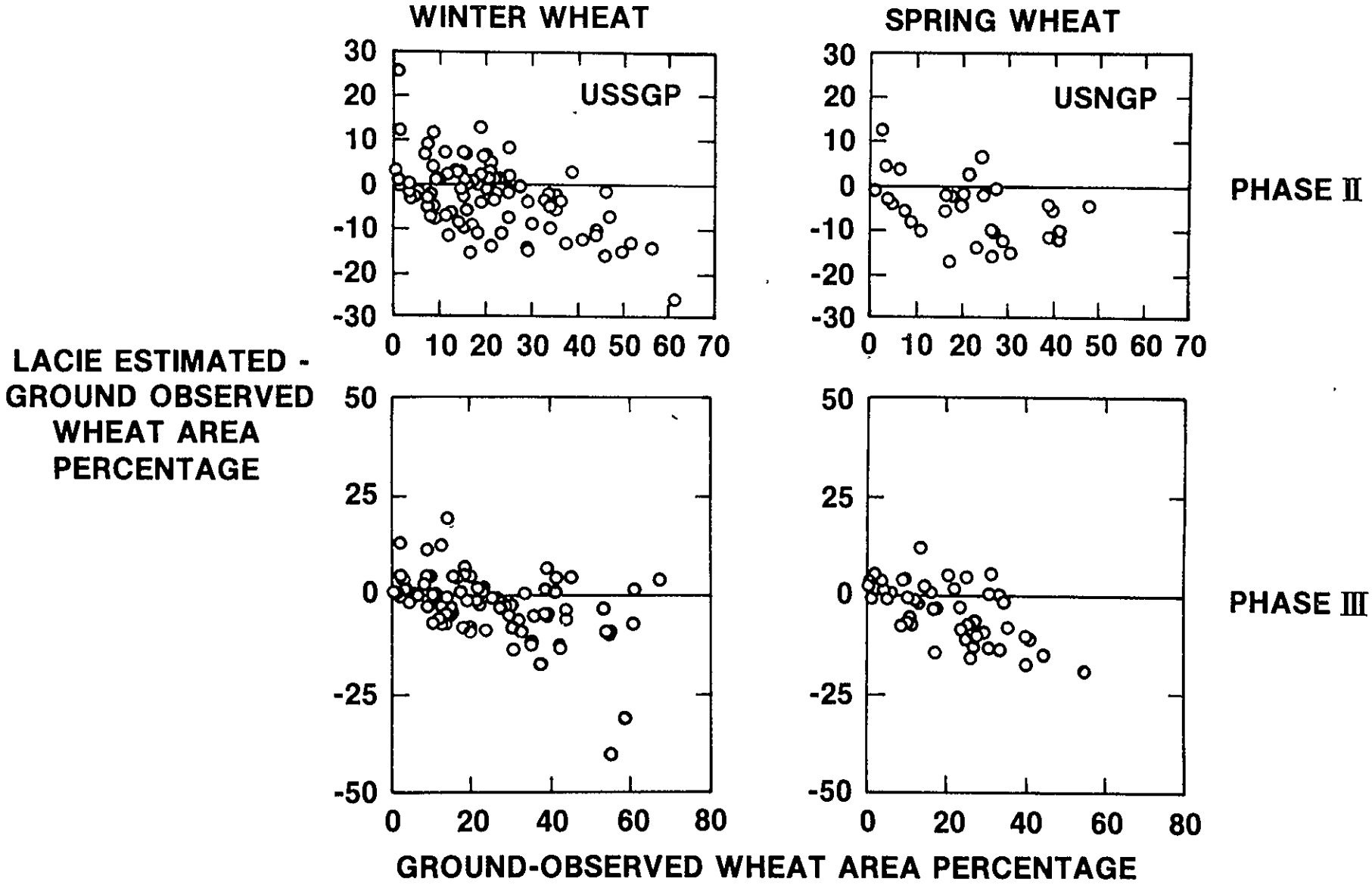
COLORADO	MONTANA
KANSAS	NORTH DAKOTA
NEBRASKA	SOUTH DAKOTA
OKLAHOMA	MINNESOTA
TEXAS	



LACIE PHASE III
AREA ESTIMATES

NASA-S-78-16126

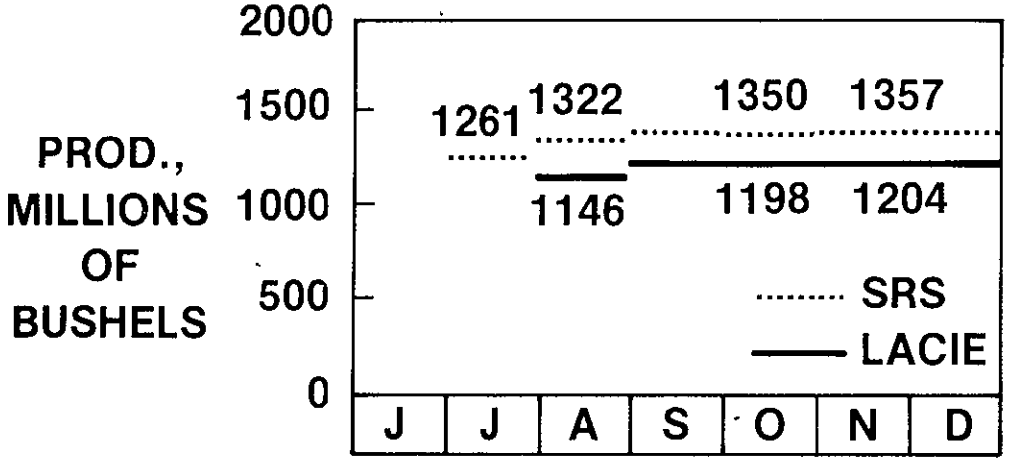
LACIE U.S. BLIND-SITE COMPARISONS



NASA S 78 16132

LACIE U.S. YARDSTICK RESULTS

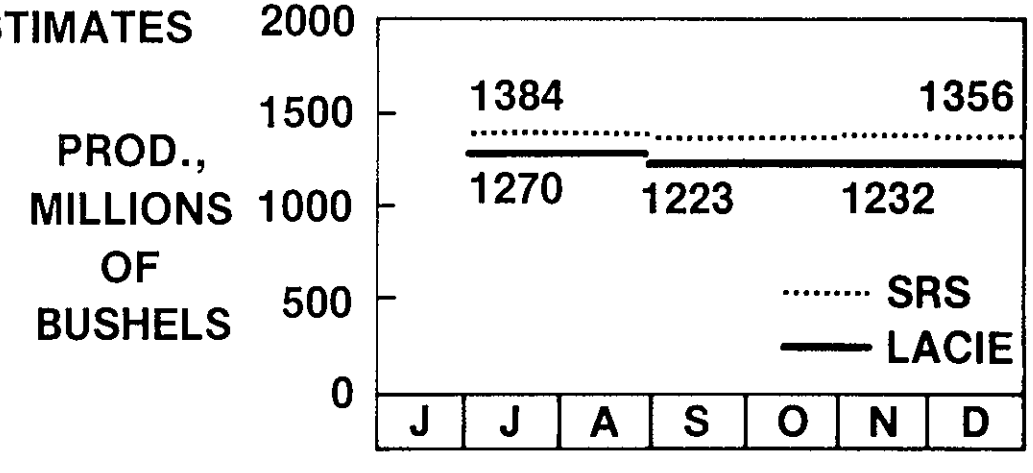
MONTHLY COMPARISONS OF LACIE AND USDA ESTIMATES PHASE II AND PHASE III



LACIE PHASE II PRODUCTION ESTIMATES

U.S. GREAT PLAINS

COLORADO	MONTANA
KANSAS	NORTH DAKOTA
NEBRASKA	SOUTH DAKOTA
OKLAHOMA	MINNESOTA
TEXAS	

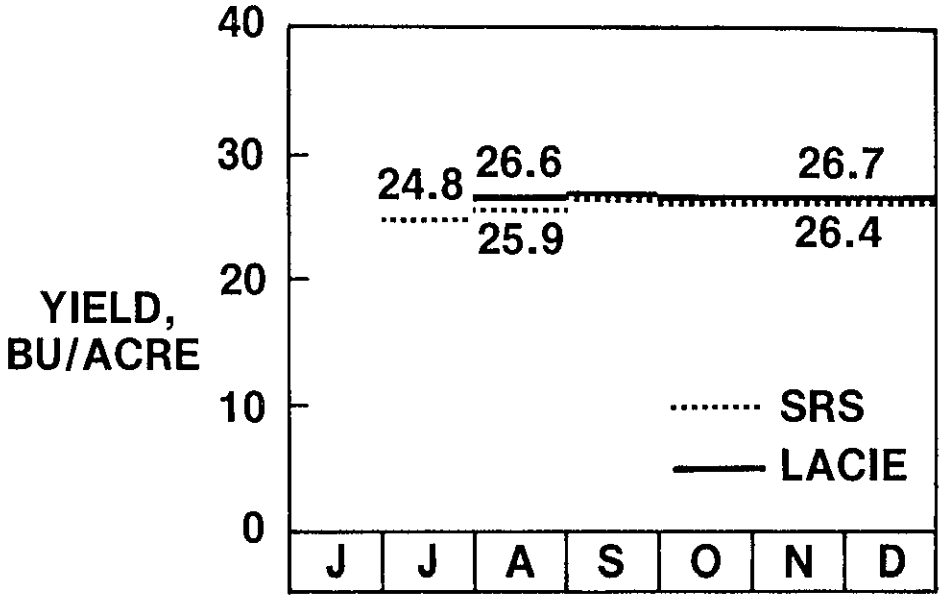


LACIE PHASE III PRODUCTION ESTIMATES

NASA-S-78-16117

LACIE U.S. YARDSTICK RESULTS

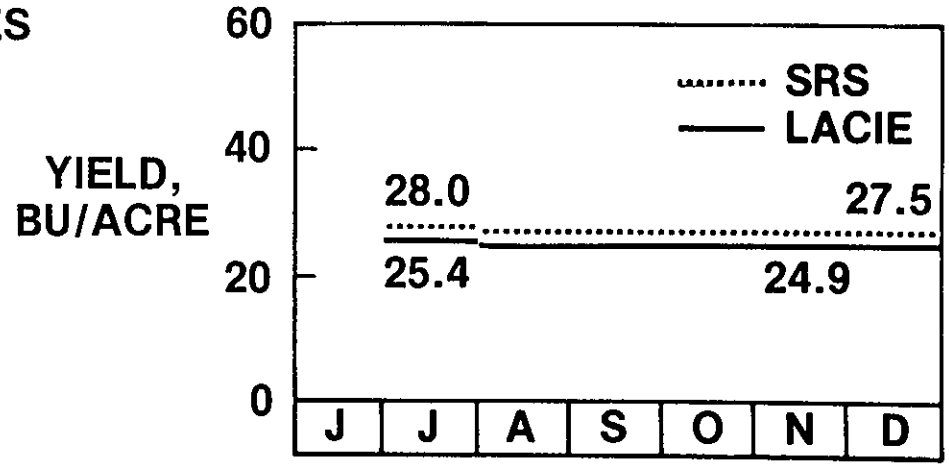
U.S. YIELD ESTIMATES



LACIE PHASE II
YIELD ESTIMATES

U.S. GREAT PLAINS

COLORADO	MONTANA
KANSAS	NORTH DAKOTA
NEBRASKA	SOUTH DAKOTA
OKLAHOMA	MINNESOTA
TEXAS	



LACIE PHASE III
YIELD ESTIMATES

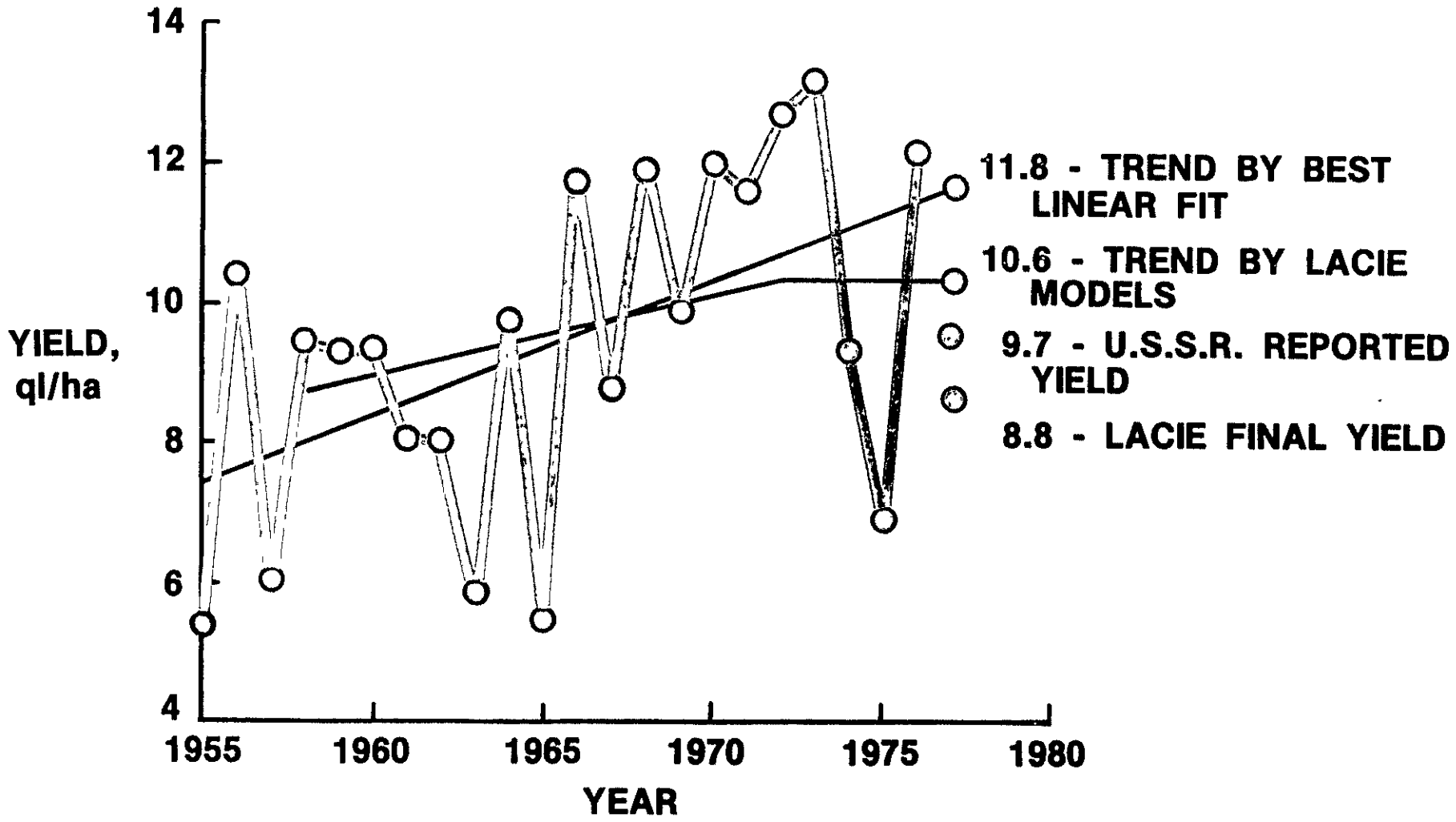
LACIE U.S. YARDSTICK RESULTS
LACIE U.S. YIELD MODEL TEST RESULTS FOR 10-YEAR PERIOD

YEAR	SRS, BU/ACRE	LACIE ESTIMATE, BU/ACRE	ERROR	WITHIN TOLERANCE?
1967	21.6	22.5	+0.9	1 YES
1968	26.0	24.6	-1.4	1 YES
1969	28.4	29.4	+1.0	1 YES
1970	28.2	26.6	-1.6	1 YES
1971	30.8	27.9	-2.9	0 NO
1972	29.3	29.1	-0.2	1 YES
1973	30.8	30.6	-0.2	1 YES
1974	23.8	28.4	+4.6	0 NO
1975	26.8	27.3	+0.5	1 YES
1976	26.4	27.1	+0.7	1 YES
1977*	27.5	24.9	-2.6	

MEAN ERROR = -0.1 BU/ACRE
RMSE = 1.90 BU/ACRE
*PHASE III RESULTS

NASA-S-78-16420

TIME SERIES OF HISTORICAL U.S.S.R. SPRING WHEAT YIELDS



NASA-S-78-16119

LACIE U.S. YARDSTICK RESULTS
CROP DEVELOPMENT MODEL RESULTS

- COMPARISONS OF GROUND-OBSERVED DATES AND MODEL-PREDICTED DATES FOR WHEAT HEADING IN 18 U.S. AND 11 CANADIAN TEST SITES AGREED TO WITHIN ±10 DAYS
  - ±7 TO 10 DAYS, U.S. WINTER AND SPRING WHEAT
  - ±5 DAYS, CANADIAN SPRING WHEAT
  - ±15 DAYS AGREEMENT WITH AVERAGE DATE
- MODELS WERE NOT AS ACCURATE IN DROUGHT-AFFECTED SEGMENTS; CROP DEVELOPED AT A FASTER RATE THAN PREDICTED
- MODELS APPEARED NOT TO WORK FOR CERTAIN DWARF OR INTERMEDIATE WHEAT VARIETIES FOUND AT MORE SOUTHERLY LATITUDES

NASA-S-78-16114

LACIE FOREIGN EXPLORATORY INVESTIGATIONS RESULTS

- CURRENT ACREAGE ESTIMATION TECHNOLOGY BELIEVED APPLICABLE IN AUSTRALIA, ARGENTINA, AND BRAZIL
- IMPROVED ACREAGE TECHNOLOGY MAY BE NEEDED TO ESTIMATE SMALL-FIELDS REGIONS IN CHINA AND INDIA
- YIELD MODELS APPEAR TO WORK ADEQUATELY IN AUSTRALIA AND INDIA
- MODELS LESS DEPENDENT ON HISTORICAL DATA REQUIRED FOR CHINA, ARGENTINA, AND BRAZIL
- CROP DEVELOPMENT STAGE MODELS APPEAR NOT TO WORK FOR THE SEMIDWARF AND INTERMEDIATE WHEAT VARIETIES GROWN AT SOUTHERN LATITUDES

NASA-S-78-16120

LACIE SYSTEMS PERFORMANCE EVALUATIONS

- LACIE EXPERIENCE WILL SUPPORT OPERATIONAL SYSTEM DESIGN TO PERMIT 14-DAY TURNAROUND FROM LANDSAT ACQUISITION TO ANALYSIS COMPLETION
  - 2000 PHASE I ACQUISITIONS
  - 9000 PHASE II ACQUISITIONS
  - 18 000 PHASE III ACQUISITIONS
- ANALYST CONTACT TIME FOR SEGMENT ANALYSIS REDUCED FROM 12 HOURS IN PHASE I TO 3 HOURS IN PHASE III – SIGNIFICANT FURTHER REDUCTIONS APPEAR POSSIBLE
- MACHINE-PROCESSING TIME REDUCED FROM HOURS PER SEGMENT IN PHASE I TO MINUTES PER SEGMENT IN PHASE III

NASA-S-78-16121

TECHNICAL ISSUES

- REDUCE NEED FOR RATIO MODELS THROUGH DIRECT OBSERVATION OF LANDSAT DATA
- DEVELOP YIELD MODELS REQUIRING LESS HISTORICAL DATA, WITH INCREASED WEATHER SENSITIVITY
  - DAILY OR WEEKLY WEATHER
  - CROP APPEARANCE FROM LANDSAT
  - MORE REFLECTIVE OF UNDERLYING PLANT PROCESSES
- IMPROVE WEATHER OBSERVATIONS THROUGH THE USE OF ENVIRONMENTAL SATELLITE DATA
- IMPROVE ANALYST INTERPRETATION PROCEDURES
- IMPROVE CROP DEVELOPMENT STAGE MODELS

NASA-S-78-16122

CONCLUSIONS

- DEMONSTRATED THAT LACIE TECHNOLOGY CAN PROVIDE IMPROVED COMMODITY PRODUCTION INFORMATION FOR BOTH U.S.S.R. WINTER AND SPRING WHEAT
- TECHNOLOGY IMPROVEMENTS NEEDED FOR CANADA AND SIMILAR REGIONS WITH
  - SMALL FIELDS
  - CONFUSION CROP PROBLEMS
- THREE YEARS OF U.S. YARDSTICK RESULTS SUPPORT THE U.S.S.R. AND CANADIAN EXPERIENCE
  - 90/90 ESTIMATES FOR WINTER WHEAT 1 TO 1.5 MONTHS PREHARVEST
  - U.S. SPRING WHEAT MORE DIFFICULT AS IN CANADA
- FIRST-GENERATION YIELD MODELS WERE GENERALLY SATISFACTORY BUT SHOULD BE IMPROVED FOR EXTREME WEATHER CONDITIONS, FOREIGN REGIONS WITH POOR HISTORICAL DATA
- SIGNIFICANT ADVANCEMENTS IN LANDSAT AND LANDSAT DATA PROCESSING CAN BE EXPECTED TO GREATLY IMPROVE CAPABILITY

NASA-S-78-16414

LACIE OBJECTIVES

- DEMONSTRATE AN IMPORTANT APPLICATION OF REPETITIVE MULTISPECTRAL REMOTE SENSING FROM SPACE
- TEST THE CAPABILITY OF LANDSAT, TOGETHER WITH CLIMATOLOGICAL, METEOROLOGICAL, AND CONVENTIONAL DATA SOURCES, TO ESTIMATE THE PRODUCTION OF AN IMPORTANT CROP
- VALIDATE TECHNOLOGY TO PROVIDE USEFUL ESTIMATES OF CROP PRODUCTION

PLENARY PRESENTATION NO 7

TECHNOLOGY TRANSFER

J Murphy, USDA

TECHNOLOGY TRANSFER OVERVIEW

- USER REQUIREMENTS
- TECHNOLOGY TRANSFER
- APPLICATION TEST SYSTEM

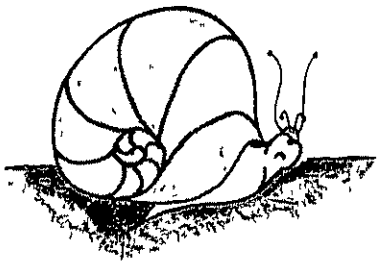
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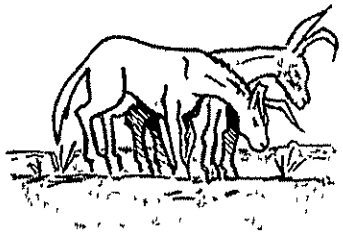
USDA REQUIREMENTS

1973 REMOTE-SENSING USER REQUIREMENTS TASK FORCE

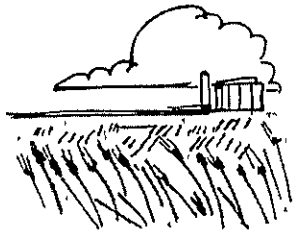
GIANT AFRICAN SNAIL



WILD BURRO HERDS



CROPS

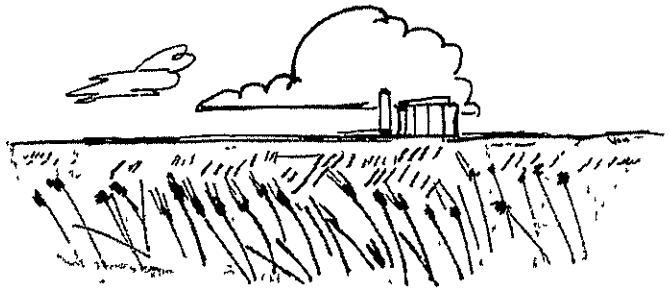


RENEWABLE RESOURCES



= 3000

1975 LACIE USER REQUIREMENTS



1977 SECRETARY INITIATIVE

EARLY WARNING	CROPS		CONSERVATION AND WATER	POLLUTION

CHANGING NEEDS MUST BE REFLECTED IN REQUIREMENTS

- USER INFORMATION NEEDS ARE CONSTANTLY CHANGING
- ADEQUATE DEFINITION IS DIFFICULT IN A DYNAMIC PROGRAM AND ECONOMIC ENVIRONMENT
- REQUIREMENT UPDATES ARE MANDATORY TO PROVIDE GUIDELINES FOR OPTIMAL EXPENDITURE OF R&D FUNDS

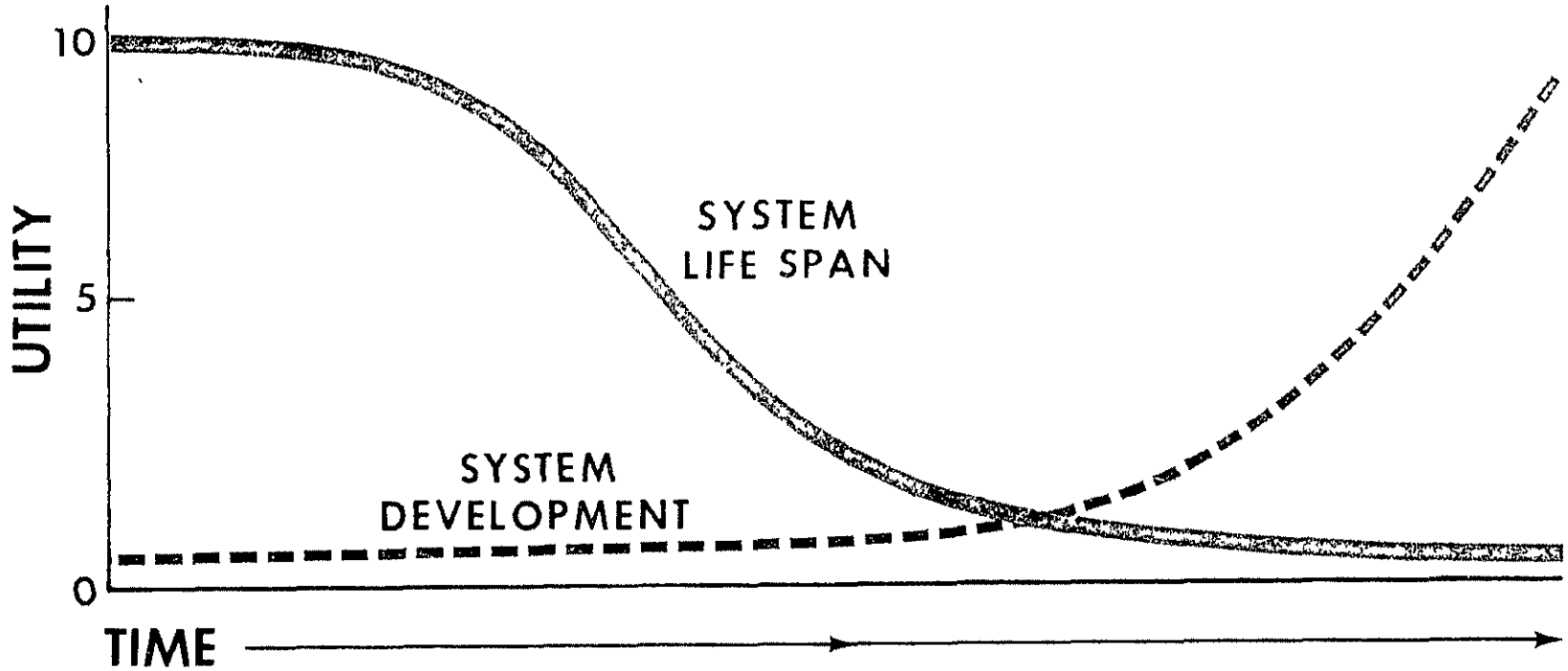
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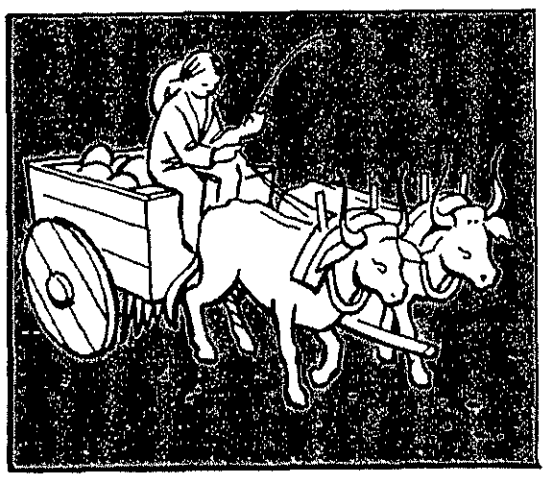
TECHNOLOGY TRANSFER

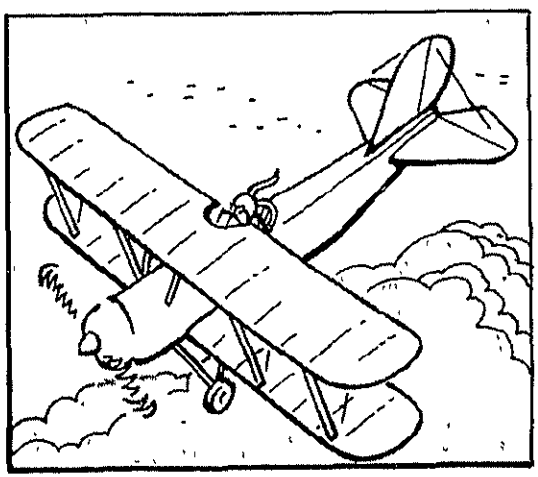
- IMPETUS TO APPLY NEW TECHNOLOGY MAY ORIGINATE FROM THE USER OR R&D COMMUNITY
- A "CLOSED LOOP" APPROACH IS ESSENTIAL TO A CLEAR DEFINITION OF RESPONSIBILITIES BETWEEN USER AND THE R&D COMMUNITY
- USER TEST AND EVALUATION
- SUPPORTING ELEMENTS NECESSARY TO SUCCESS

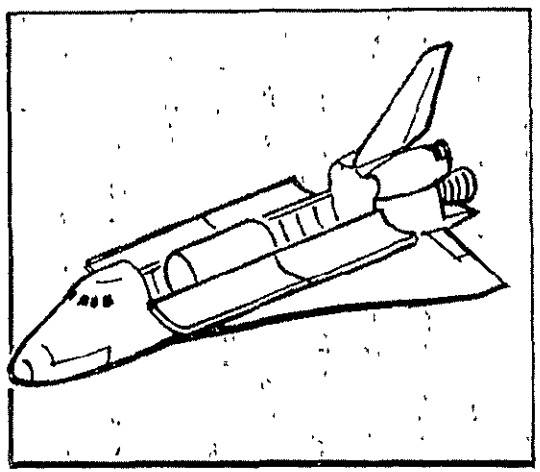
NASA-S-78-16161

SYSTEM LIFE









NASA-S-78-17262

PRESENT STATUS OF THE ATS
1978

TECHNOLOGY TRANSFERRED

- SAMPLING STRATEGY
- YIELD MODELS (SOIL MOISTURE BUDGET)
- SPECTRAL ANALYSIS PROCEDURES
- VEGETATIVE INDEXES
- 30 TRAINED USDA PROFESSIONALS

ATS SYSTEM COMPONENTS

- ANALYSIS HARDWARE AND SOFTWARE
- COLOR GRAPHIC TERMINALS
- OPERATING PROCEDURES

ATS CAPABILITY

- APPLICATION TEST OF SPRING WHEAT PRODUCTION IN U.S.S.R.
- VALIDATE CONDITION ASSESSMENT IN MONTANA AND NORTH DAKOTA SPRING WHEAT AREA
- VALIDATE AREAS OF MOISTURE STRESS IN U.S.S.R. SPRING WHEAT

NASA-S-78-17263

PRESENT STATUS OF THE ATS (CONT)
1979

TECHNOLOGY TRANSFERRED

- FULL-FRAME DATA HANDLING TECHNIQUES
- UPDATED LACIE TECHNIQUES FOR WHEAT, CORN, AND SOYBEANS

ATS SYSTEM COMPONENTS

- DATA ACQUISITION HARDWARE AND SOFTWARE
- LINK BETWEEN ACQUISITION AND ANALYSIS COMPONENTS
- PROCURE DATA BASE COMPONENT

ATS CAPABILITY

AT THE DISCRETION OF USDA MANAGEMENT:

- CONDITION ASSESSMENT
- PRODUCTION IMPACTS
- AVAILABLE YIELD MODELS
- GEOGRAPHIC DATA BASES

NASA-S-78-16157

TYPICAL ANALYST STATION ARRANGEMENT



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OF POOR QUALITY

PLENARY PRESENTATION NO. 8

IMPACT OF LACIE ON A NATIONAL METEOROLOGICAL CAPABILITY

N Strommen, NOAA

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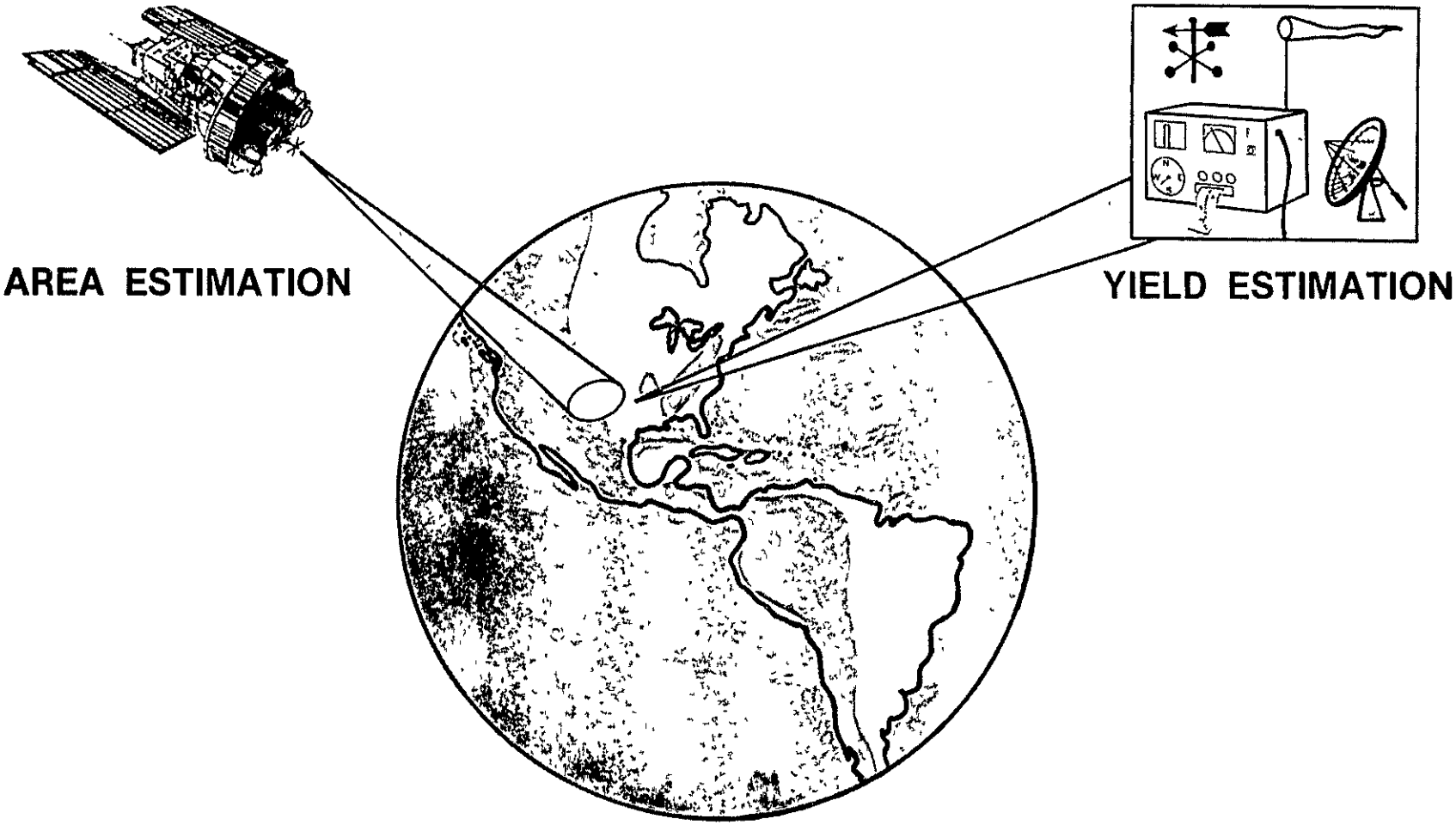
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THE IMPACT OF LACIE ON A NATIONAL METEOROLOGICAL CAPABILITY

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NASA-S-78-16389

LACIE METHODOLOGY



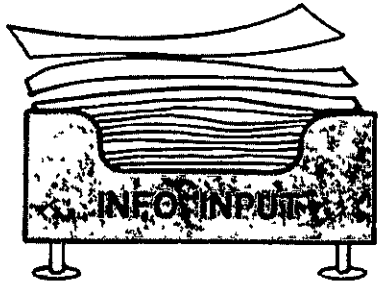
PRODUCTION = AREA x YIELD

NASA-78-16380

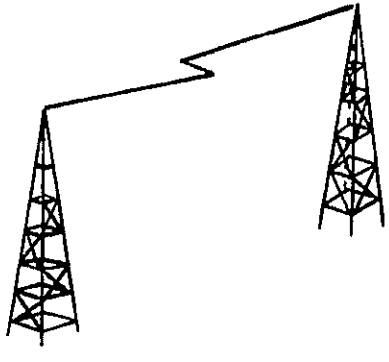
CAPABILITY REQUIRED TO SUPPORT LACIE OBJECTIVES



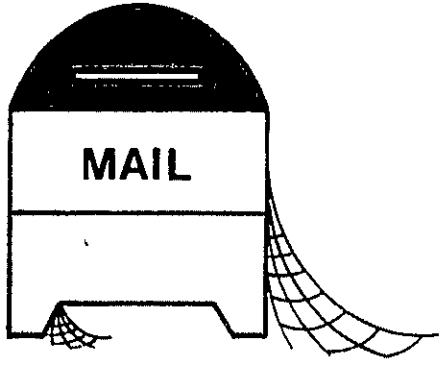
GLOBAL CAPABILITY

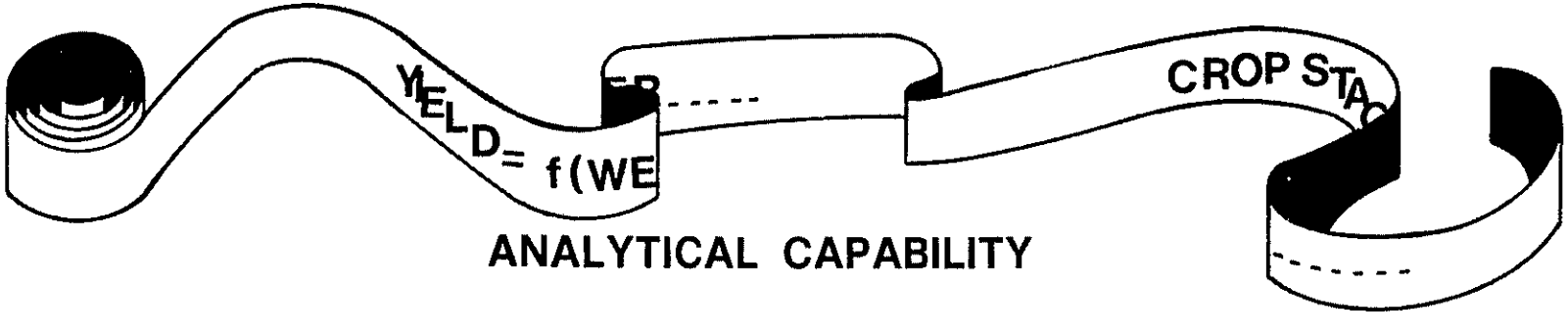


COMPREHENSIVE CAPABILITY



TIMELY CAPABILITY

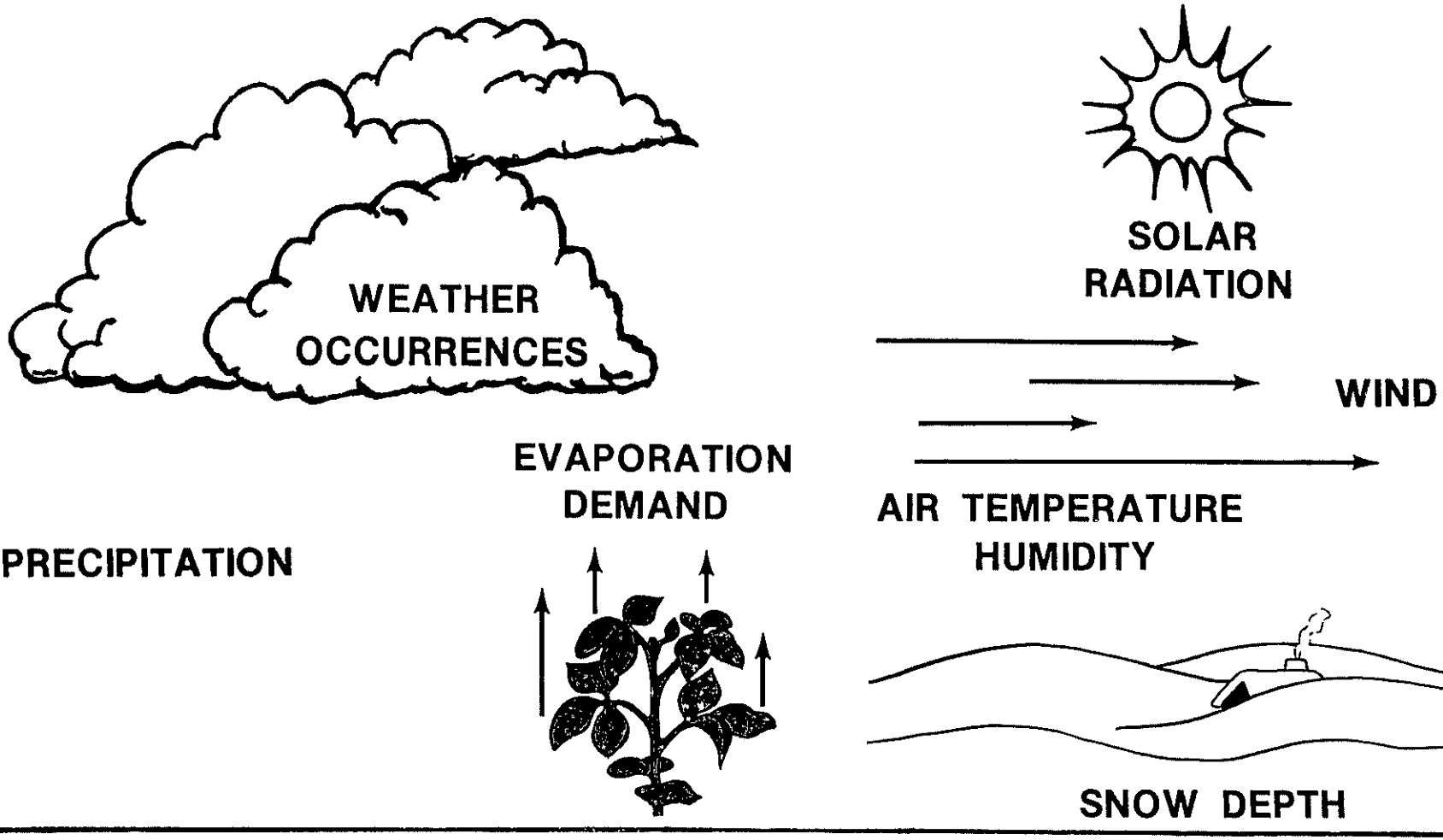




ANALYTICAL CAPABILITY

NASA-S-78-16378

METEOROLOGICAL DATA REQUIRED TO DEFINE THE GROWING ENVIRONMENT IN A CROP REGION



NASA-S-78-16388

TRADITIONAL WEATHER SERVICES SUPPORTED BY GLOBAL DATA ACQUISITION



PROGRAM AREAS

AVIATION

MARINE

PUBLIC SERVICE



FORECASTING

DATA REQUIREMENTS

UPPER-AIR SOUNDINGS

SURFACE REPORTS

FORECASTS



ANALYSIS

GLOBAL SURFACE WEATHER ANALYSIS BASED ON REPORTS FROM ABOUT 2500 OBSERVING STATIONS RECOMMENDED FOR GLOBAL EXCHANGE BY THE WMO

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Houston Texas 77058

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REPORTING

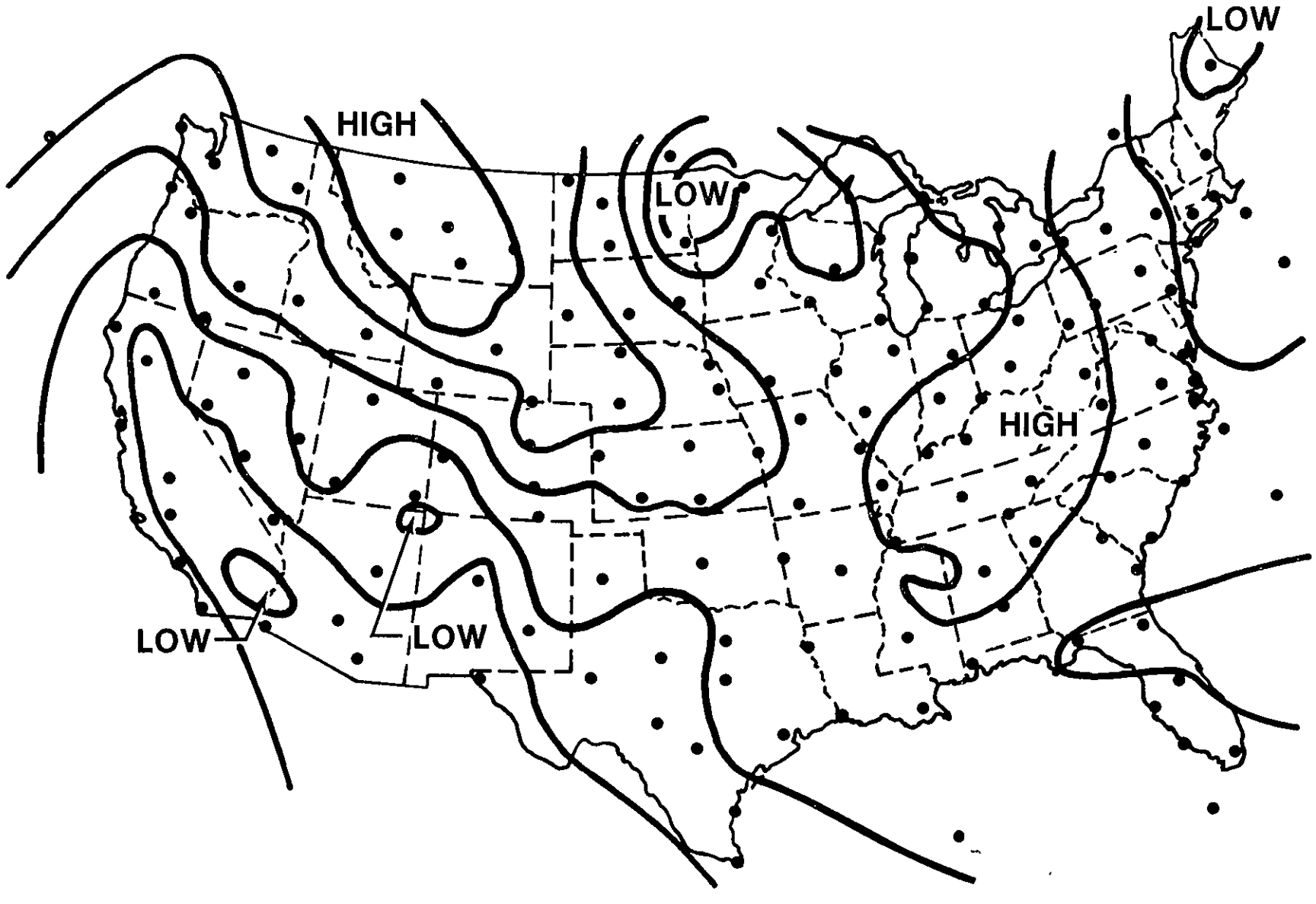
DATA ELEMENTS: SKY COVER, WIND, PRESSURE, VISIBILITY, TEMPERATURE

SYNOPTIC CODE:

Nddff	YVWWw	PPPTT	$N_hC_LhC_mC_h$	$T_{dd}{}^{app}$
51810	74010	02310	862//	08216

NASA-S-78-16392

U.S. DAILY WEATHER MAP - JUNE 1, 1978



NASA-S-78-16390

CLIMATOLOGICAL PROGRAMS

- DAILY WEATHER OBSERVATIONS OF:
  - PRECIPITATION TOTALS
  - TEMPERATURE EXTREMES
  - SNOW DEPTH
- OBSERVATIONS RECORDED AND MAILED AT THE END OF EACH MONTH
- REPORTS PROCESSED BY EACH COUNTRY AND PUBLISHED WITHIN 1 TO 12 MONTHS
- TELEGRAPHIC "CLIMAT" REPORTS FROM SELECTED SYNOPTIC OBSERVING STATIONS AT THE END OF EACH MONTH
  - MONTHLY AVERAGE TEMPERATURE
  - TOTAL MONTHLY PRECIPITATION

NASA-S-78-16385

- NEEDED METEOROLOGICAL ELEMENTS WERE NOT AVAILABLE IN A TIMELY MANNER. ONLY IN THE U.S. AND OTHER LIMITED AREAS WERE DAILY PRECIPITATION AND TEMPERATURE EXTREMES AVAILABLE

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- TIMELY METEOROLOGICAL DATA DID NOT HAVE MANY OF THE NEEDED WEATHER ELEMENTS

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?

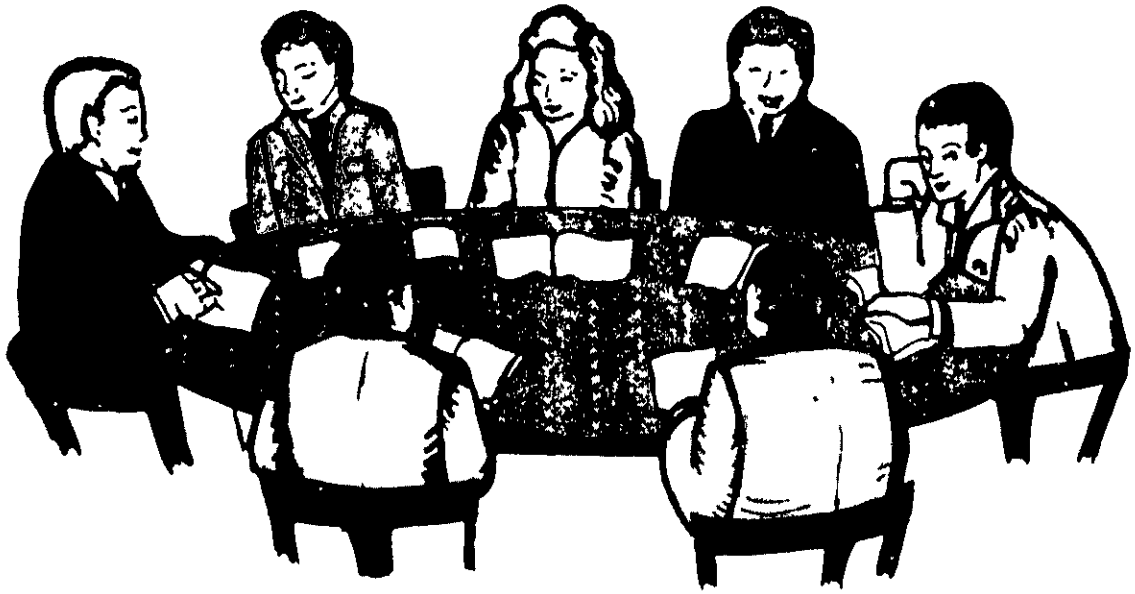
DILEMMA

APPROACH SELECTED:

- IMPROVE EXISTING DATA
- MAXIMIZE USE OF AVAILABLE DATA

NASA-S-78-16383

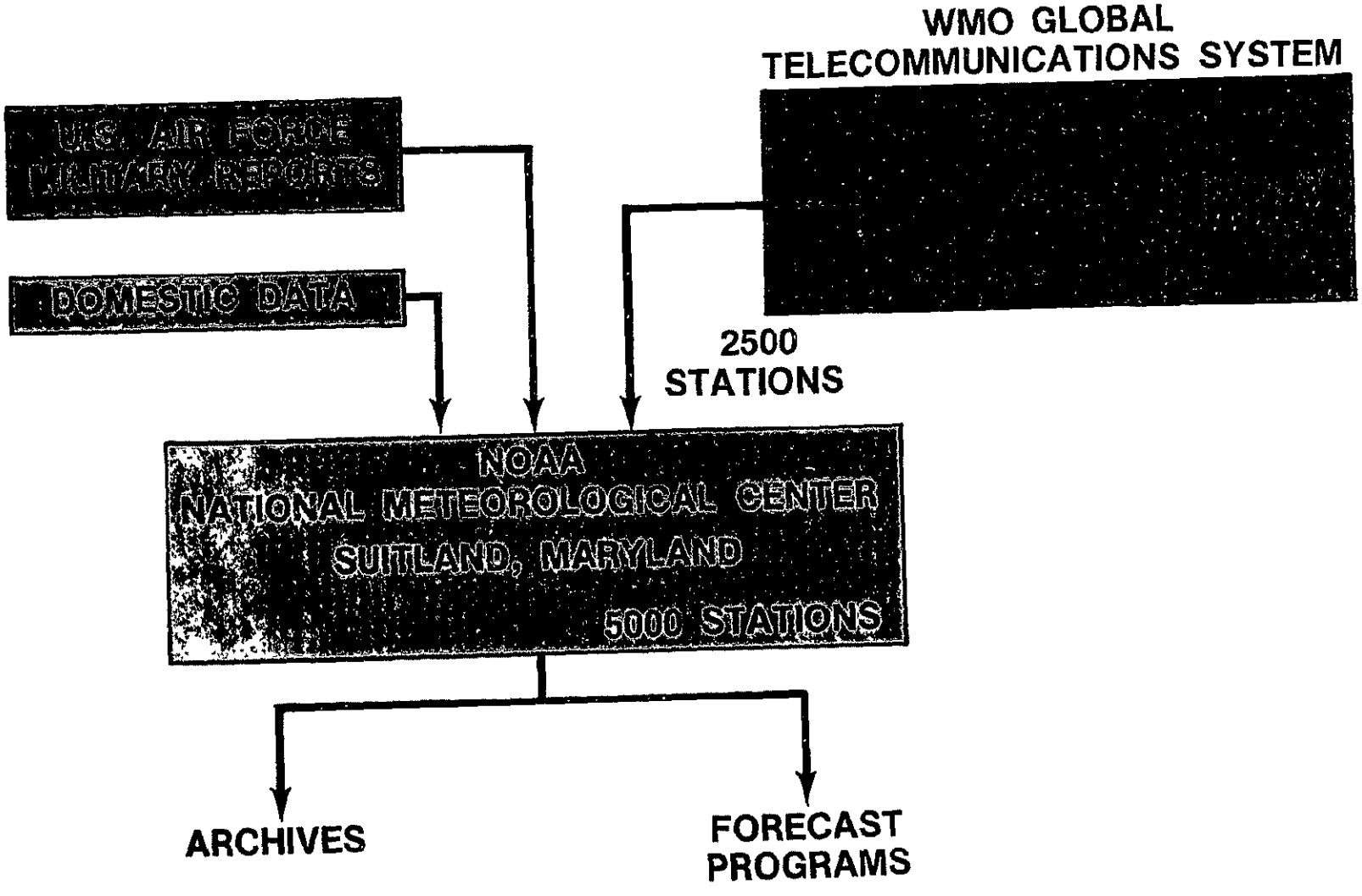
- IN RESPONSE TO A U.S. INITIATIVE IN 1977, THE WMO RECOMMENDED THE INCLUSION OF DAILY TEMPERATURE EXTREMES IN ALL INTERNATIONAL RELAYS OF SYNOPTIC WEATHER DATA



C3

NASA-S-78-16375

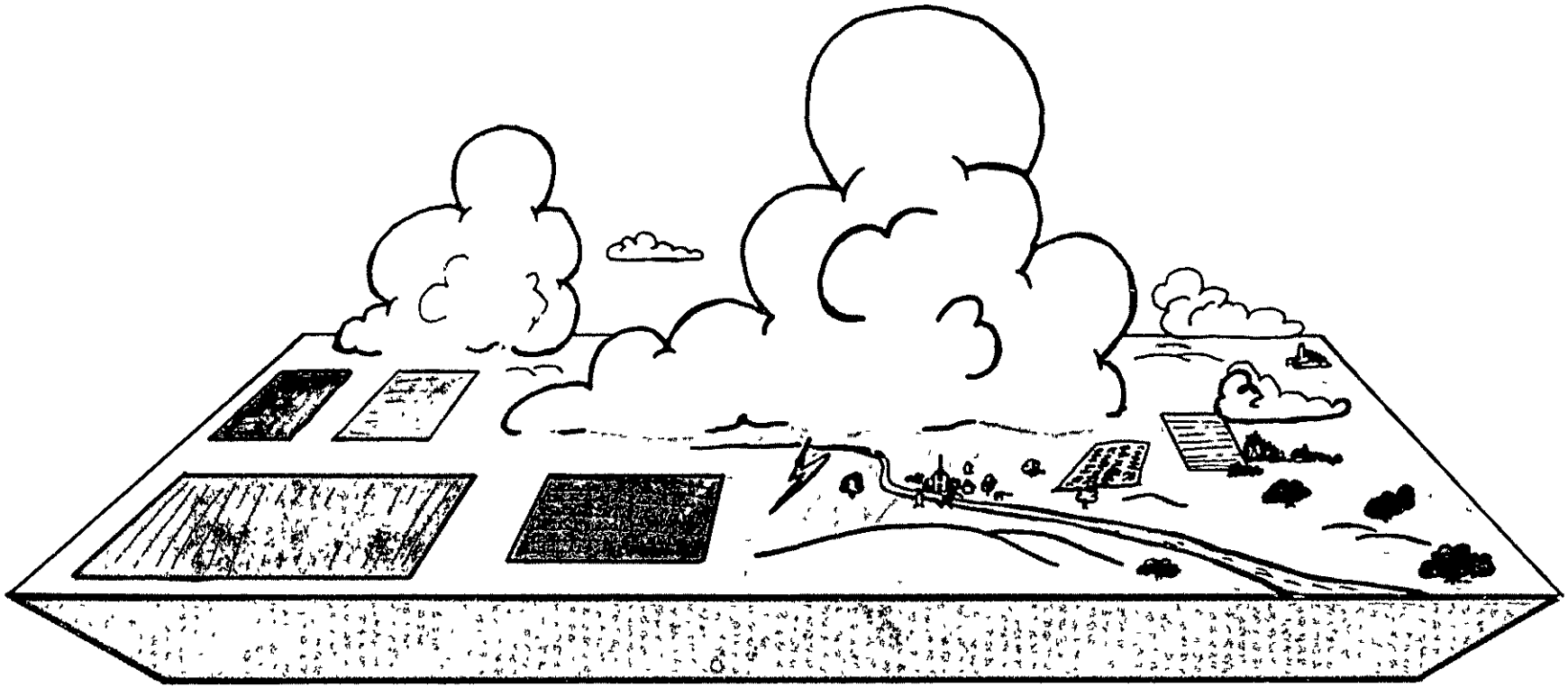
U.S. SYSTEM TO GATHER GLOBAL METEOROLOGICAL DATA



NASA-S-78-16382

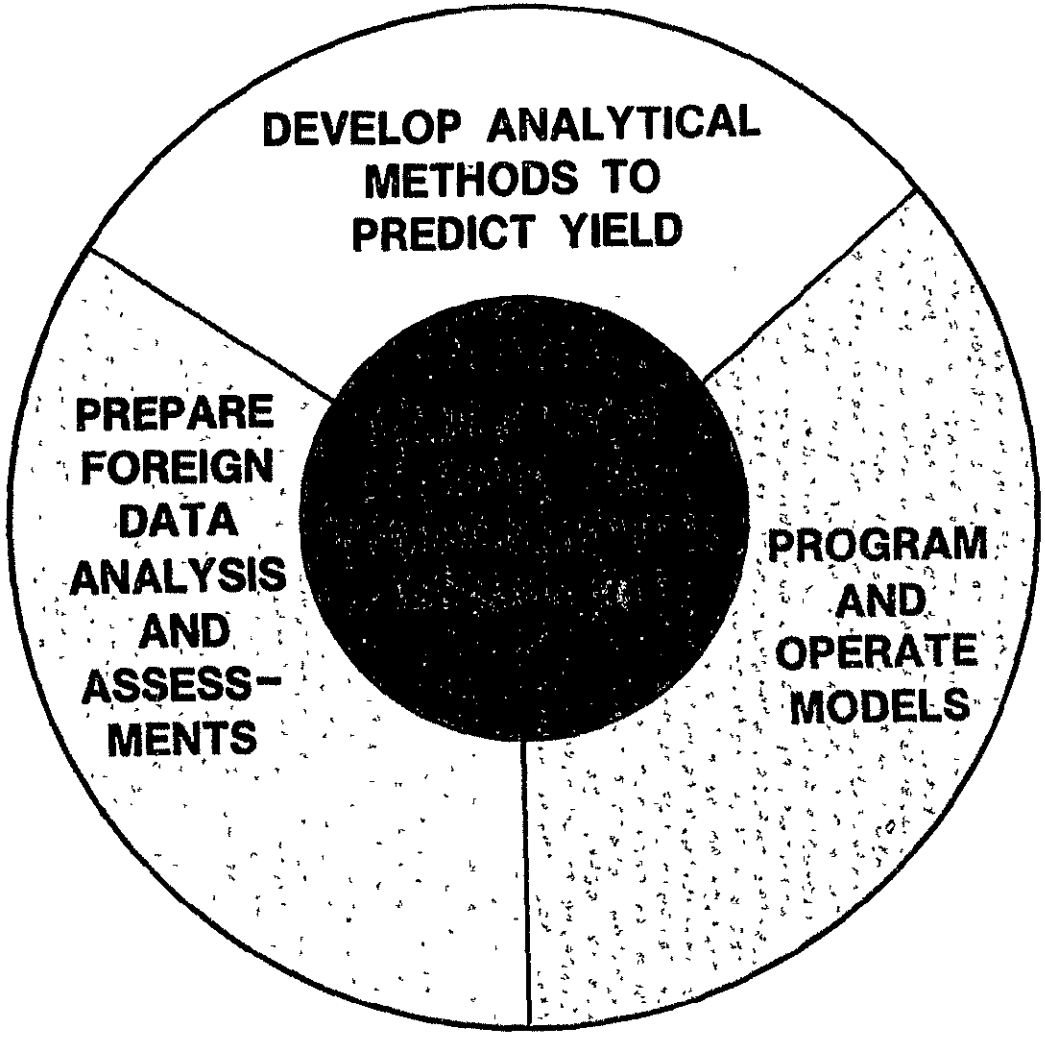
DAILY PRECIPITATION DATA WERE AVAILABLE

- AIR FORCE REPORTS RELAYED TO NMC
- ADDITIONAL SYNOPTIC CODE GROUPS RELAYED BY WMO OVER AND ABOVE THOSE RECOMMENDED

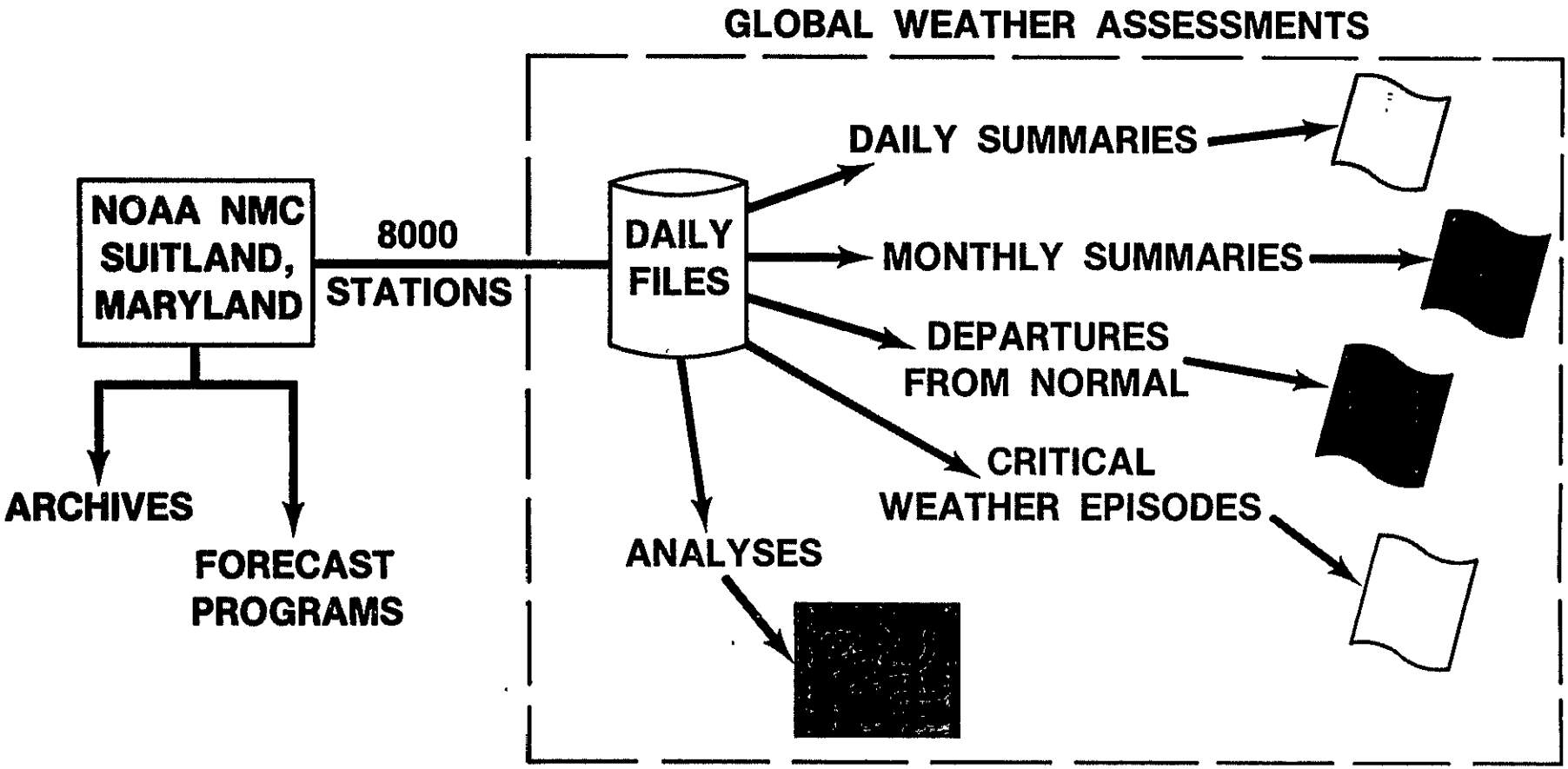


NASA-S-78-16381

ORGANIZATIONAL RESPONSE BY NOAA



NEW DIMENSION ADDED TO THE PROCESSING OF METEOROLOGICAL DATA



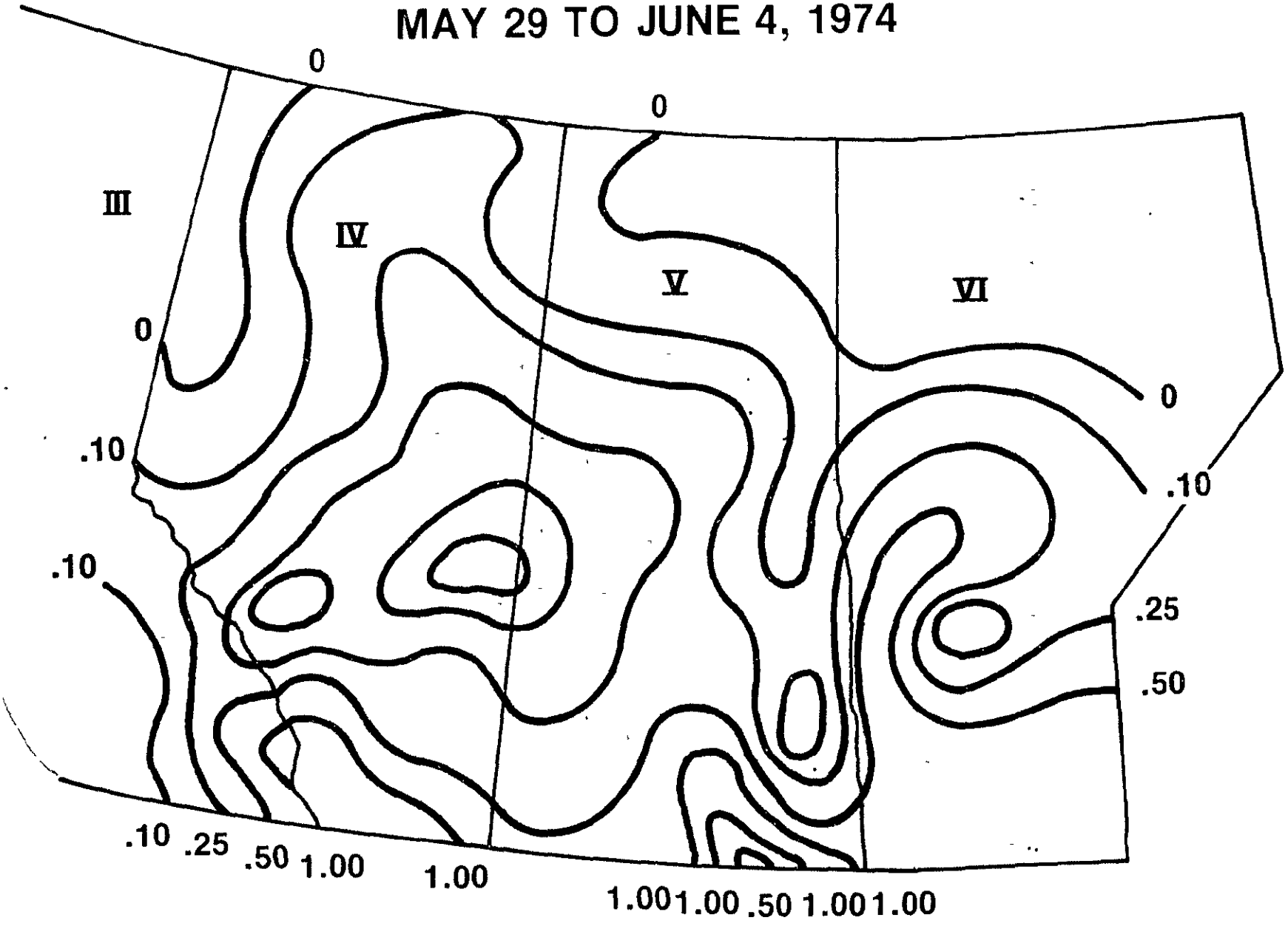
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ACTUAL PRECIPITATION (INCHES)

MAY 29 TO JUNE 4, 1974

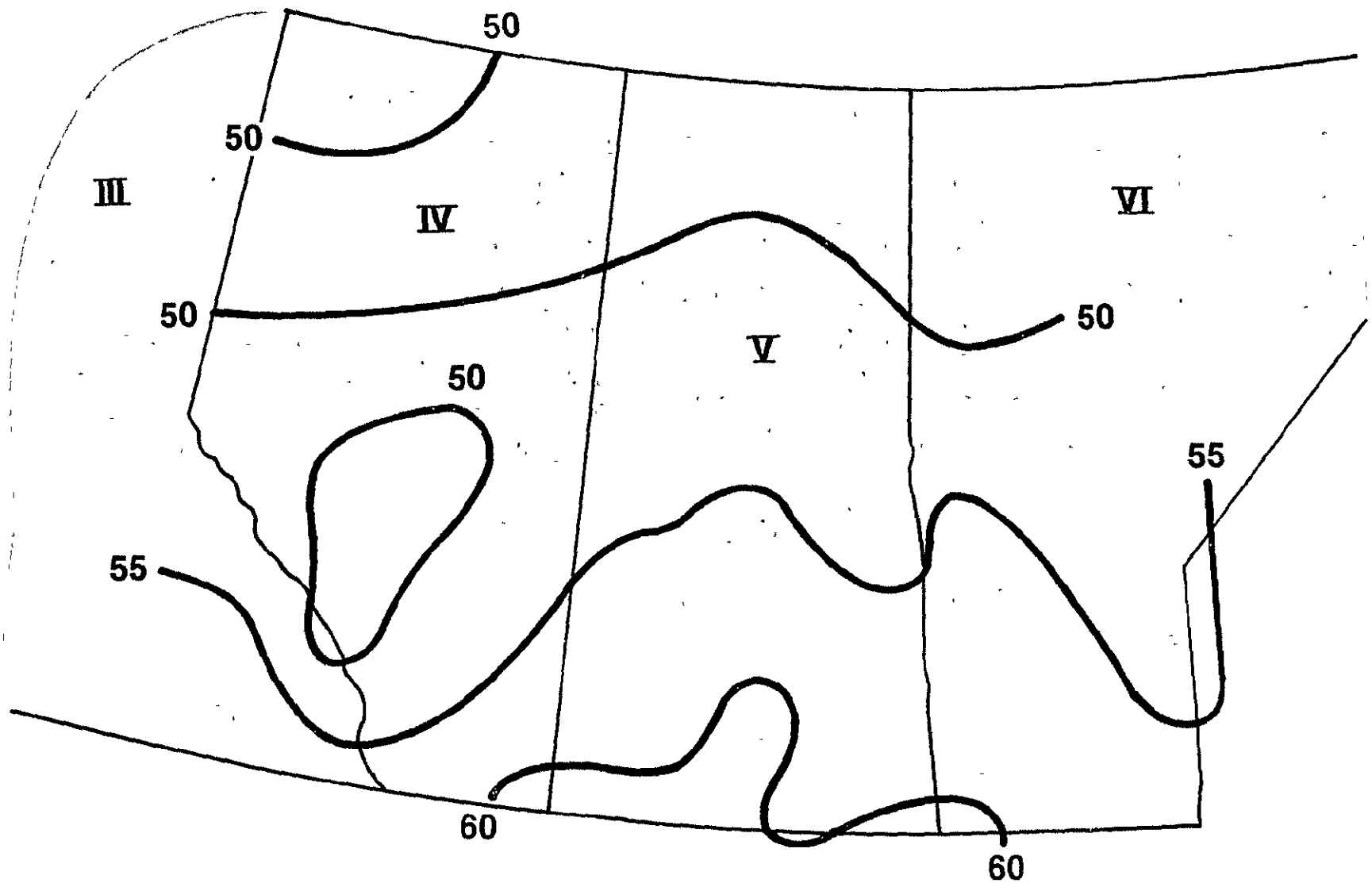


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NASA-S-78-16373

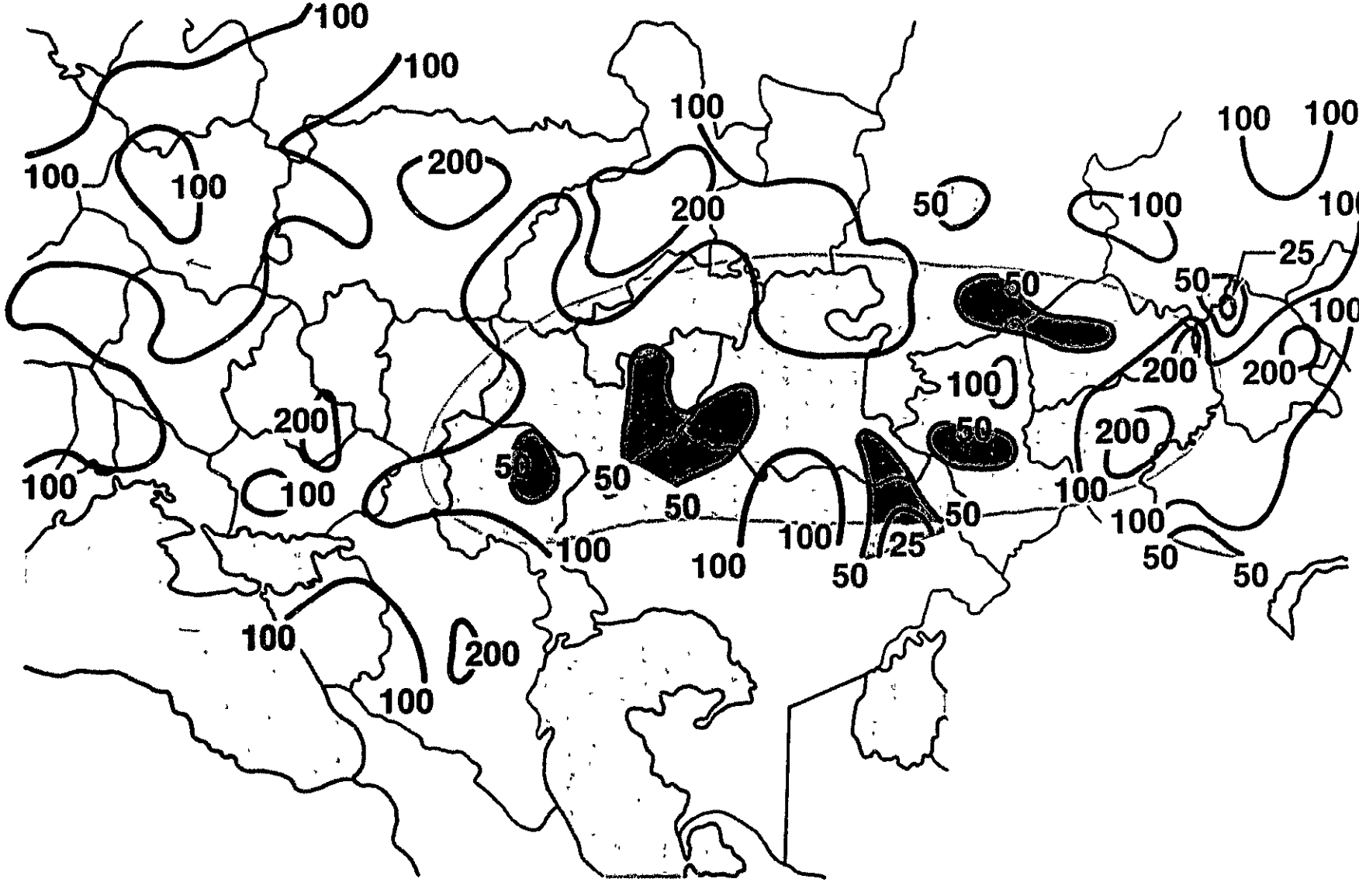
CANADIAN PRAIRIE PROVINCES
ACTUAL AVERAGE TEMPERATURES (°F)



NASA-S-78-16372

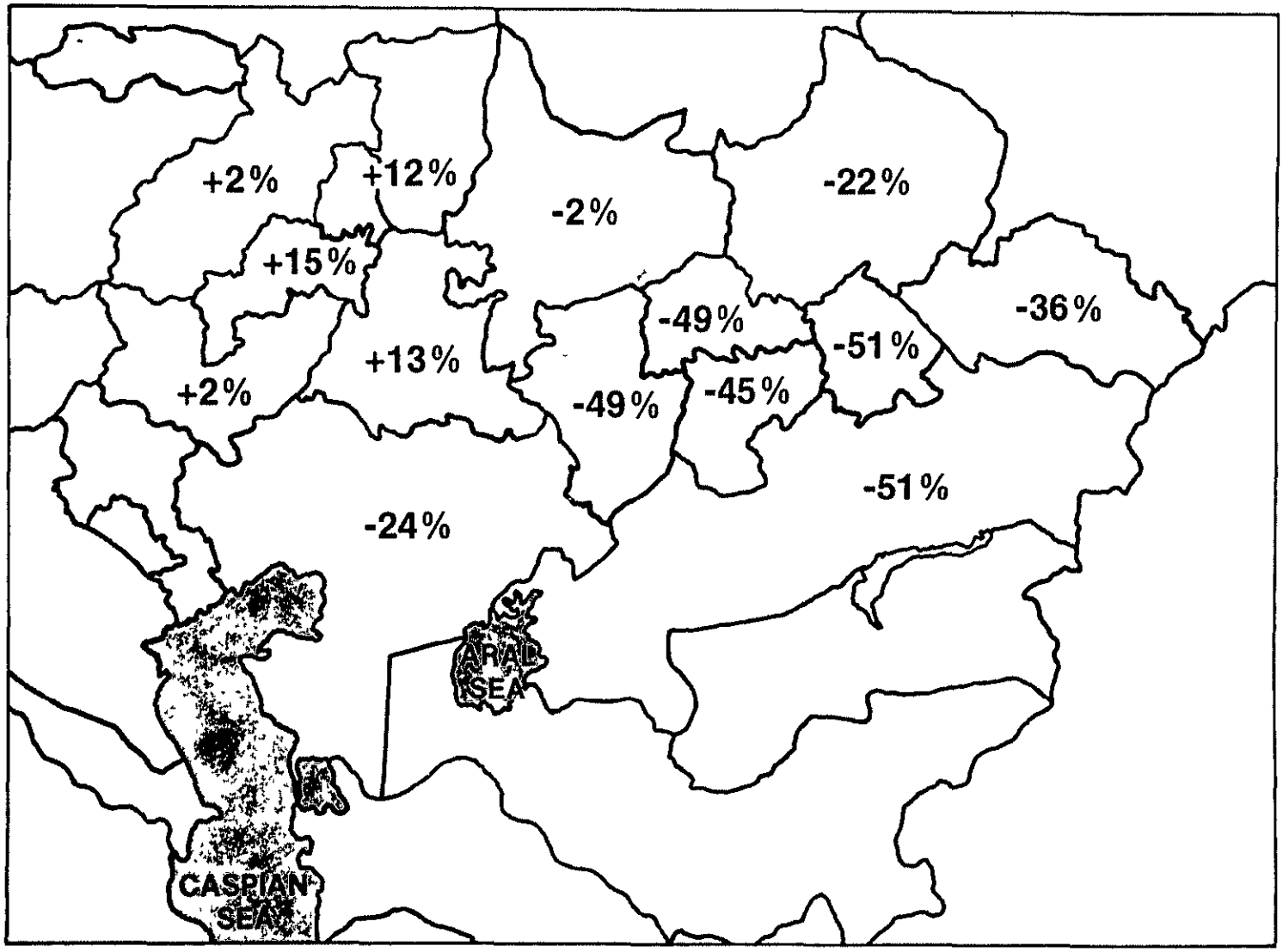
U.S.S.R. - PERCENT OF MEAN PRECIPITATION

MAY 1977



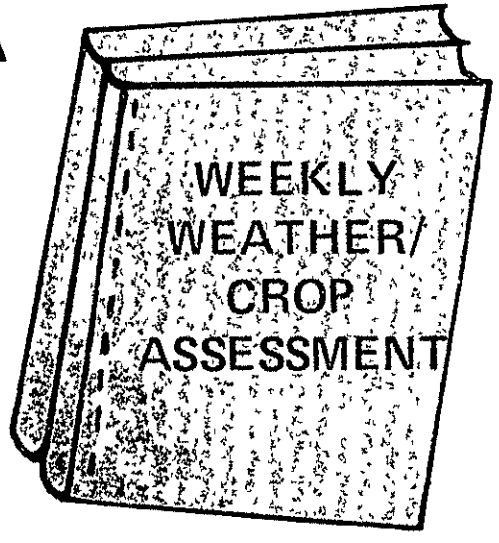
NASA-S-78-16376

FORECAST DEPARTURES FROM NORMAL SPRING WHEAT YIELD (PERCENT) U.S.S.R., AUGUST 1977



NASA-S-78-16379

NEW CAPABILITIES IN APPLICATION OF METEOROLOGICAL DATA



- FOREIGN CROP AND WEATHER ASSESSMENT IS A ROUTINE GOVERNMENT PUBLICATION PREPARED BY NOAA WITH THE ASSESSMENT AND COOPERATION OF USDA



- MODELING OF WEATHER IMPACTS, WHICH WAS SUCCESSFULLY DEMONSTRATED FOR WHEAT IN LACIE, HAS BEEN EXTENDED TO NATURAL GAS CONSUMPTION

- SPECIAL WEATHER IMPACT ASSESSMENTS ARE BEING PROVIDED TO THE AID TO ASSIST THEIR PROGRAMS IN LESSER DEVELOPED NATIONS

NASA-S-78-16494

LACIE IMPACT

- A NEW NATIONAL CAPABILITY
  - FOR ASSESSING WEATHER IMPACTS ON FOOD SUPPLIES
  - FOR APPLICATION TO OTHER CRITICAL CONCERNS
- STIMULATED SIMILAR WORK IN PRIVATE INDUSTRY

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NASA-S-78-16496

NEEDED IMPROVEMENTS IN GLOBAL METEOROLOGICAL DATA CAPABILITY

- CONSISTENT WEATHER REPORTING
- REPORTING OF CROP-RELATED ELEMENTS
- SUPPLEMENT WITH ENVIRONMENTAL SATELLITE DATA

NASA-S-78-16495

AREAS OF FURTHER APPLICATION OF METEOROLOGICAL DATA TO GLOBAL FOOD MONITORING AND ASSESSMENT

- IMPROVED RESOLUTION OF GROWING CONDITIONS
- INCREASED VARIETY OF INFORMATION
- IMPROVED CROP YIELD AND DEVELOPMENT MODELS
- INCORPORATE FUTURE DEVELOPMENTS IN EXTENDED WEATHER FORECASTING

PLENARY PRESENTATION NO. 9

CONCLUSIONS AND OUTLOOK

B Erb, JSC

CONCLUSIONS AND OUTLOOK

OUTLINE

- THE MAJOR CONCLUSIONS OF LACIE
- THE AVAILABILITY OF THE TECHNOLOGY
- RECOMMENDATIONS AND OUTLOOK

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NASA-S-78-16029

MAJOR CONCLUSIONS OF LACIE

- GENERAL
  - CAN PROVIDE IMPROVED WHEAT PRODUCTION INFORMATION IN REGIONS SIMILAR TO U.S.S.R. AND U.S. HARD RED WINTER WHEAT AREA
  - SIGNIFICANT IMPROVEMENTS IN CAPABILITIES TO MONITOR WHEAT CAN BE EXPECTED IN THE NEAR FUTURE
  - REMOTE SENSING AND WEATHER EFFECTS MODELING APPROACH OF LACIE IS GENERALLY APPLICABLE TO OTHER MAJOR CROPS AND REGIONS

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MAJOR CONCLUSIONS OF LACIE (CONT)

- AGRICULTURAL REMOTE-SENSING APPLICATIONS RESEARCH REQUIRES CERTAIN CHARACTERISTICS
  - AN INTERDISCIPLINARY TEAM
  - SEVERAL YEARS TESTING AND DATA SETS OVER EXTENSIVE GEOGRAPHIC REGIONS
  - RIGOROUS ACCURACY ASSESSMENT ALONG WITH GROUND DATA
    - UNDERSTANDING OF EXPERIMENTAL RESULTS
    - IDENTIFICATION AND CORRECTION OF DEFICIENCIES
  - DIVERSE SCIENTIFIC DISCIPLINES PURSUING R&D ON TECHNICAL ISSUES THAT ARISE FROM THE PROJECT
  - PEER REVIEW FOR ESSENTIAL FEEDBACK

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MAJOR CONCLUSIONS OF LACIE (CONT)

- ACHIEVEMENTS
  - PRODUCTION ESTIMATES SUPPORTED PERFORMANCE GOALS IN U.S.S.R., U.S. GREAT PLAINS
  - TECHNOLOGY VALIDATED FOR SOME PRODUCING REGIONS
  - IDENTIFIED NEEDED IMPROVEMENTS IN OTHER REGIONS
    - HIGHER SPATIAL RESOLUTION
    - ADDITIONAL SPECTRAL BANDS
    - INCREASED TEMPORAL COVERAGE
  - LANDSAT DATA AVAILABLE FOR ANALYSIS IN 14 DAYS
  - LANDSAT DATA ANALYSIS COULD BE COMPLETED IN 14 DAYS IN STATE-OF-THE-ART SYSTEM

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MAJOR CONCLUSIONS OF LACIE (CONC)

- ACHIEVEMENTS (CONT)
  - WORKABLE YIELD MODELS AND STAGE-OF-MATURITY MODELS DEVELOPED
  - RIGOROUS ACCURACY ASSESSMENT QUANTIFIED PERFORMANCE INCLUDING EFFECTS OF IMPROVEMENTS TO TECHNOLOGY
  - SR&T IMPROVED SIGNIFICANTLY THE METHODOLOGY AND EFFICIENCY
  - TECHNOLOGY EVALUATED IN MAJOR REGION OF U.S., CANADA, AND U.S.S.R.
  - INSIGHT GAINED FROM EXPLORATORY INVESTIGATIONS IN 5 OTHER COUNTRIES

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AVAILABILITY OF THE TECHNOLOGY

- AVAILABLE ON A SELECTED BASIS FOR U.S. FEDERAL GOVERNMENT USE AND FOR OTHER GOVERNMENTS WITH ACCESS TO GROUND STATIONS COVERING THEIR OWN COUNTRY
- MORE GENERAL AVAILABILITY WILL DEPEND ON DECISIONS REGARDING SATELLITE SPECTRAL DATA
  - AVAILABILITY
  - RELIABILITY
  - COST
  - DISTRIBUTION MECHANISM
- SELECTED PORTIONS TO BE USED BY ELEMENTS OF THE U.S. GOVERNMENT
- PORTIONS AVAILABLE FOR PRIVATE AND INTERNATIONAL USE

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RECOMMENDATIONS AND OUTLOOK

- THE MANIFEST NEED FOR GLOBAL FOOD INVENTORY INFORMATION INDICATES THAT WE SHOULD
  - PURSUE IMPROVED WHEAT INVENTORY TECHNOLOGY DEVELOPMENT
  - INITIATE MULTICROP EXPERIMENTS
- CURRENTLY AVAILABLE TECHNOLOGY CAN BE EXPLOITED IMMEDIATELY
- IMPROVED INTERACTION BETWEEN ALL LEVELS OF USERS AND THE TECHNOLOGY DEVELOPERS SHOULD BE ENCOURAGED

RECOMMENDATIONS AND OUTLOOK (CONT)

- WITH SUITABLE EFFORT, THIS SATELLITE-AIDED TECHNOLOGY WILL SHOW SIGNIFICANT IMPROVEMENT AND COULD BE IN WIDESPREAD USE BY THE LATE 1980's
- CURRENT FOLLOW-ON ACTIVITY BY THE PARTICIPATING AGENCIES IS AIMED AT
  - RESOLUTION OF REMAINING CRITICAL ISSUES ON WHEAT
  - INITIAL EXPLORATORY STUDIES IN CORN AND SOYBEANS
- ACTIVITY FOR THE EARLY 1980's WILL BUILD ON THE LACIE EXPERIENCE AND ADDRESS THE BROADER NEEDS OF THE USDA


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